

ENVIRONMENTAL  
PROTECTION

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# Review of progress at industrial hot spots

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# Preface

The Baltic Sea Joint Comprehensive Environmental Action Programme (JCP) developed by a task force appointed by the Helsinki Commission (HELCOM), was approved in 1992 by the Ministers of the Environment in their Baltic Sea Environment Declaration. The key principles of the JCP are to recognise the importance of a long term perspective for ecological restoration, harmonise economic and environmental objectives, control pollution at the source and establish conditions for private sector participation. The Programme is to be implemented over 20 years (1993-2012) at an estimated total cost of 18 Milliard EUR. The Baltic Sea JCP is focused on 132 serious pollution sources, the so called hot spots in the Baltic Sea catchment area. 50 of these serious pollution sources were classified as industrial hot spots. In order to assess the progress at hot spots an annual review is carried out by the HELCOM PITF. Finland and Sweden have the lead party responsibility for the Point Source Pollution element of the JCP. Finland takes the responsibility to co-ordinate and assess the implementation of measures at the industrial hot spots while Sweden's responsibility covers combined municipal and industrial waste water treatment.

This report includes a review on industrial hot spots based on data compiled from available sources during the summer of year 2000. The report has been elaborated at the Finnish Environment Institute and the views expressed do not necessarily reflect the views of HELCOM and its Contracting Parties.



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## Executive summary

The Baltic Sea Joint Comprehensive Environmental Action Programme (JCP) developed by a task force appointed by the Helsinki Commission (HELCOM), was approved in 1992 by the Ministers of the Environment in their Baltic Sea Environment Declaration. The key principles of the JCP are to recognise the importance of a long-term perspective for ecological restoration, harmonise economic and environmental objectives, control pollution at the source and establish conditions for private sector participation. The Programme is to be implemented over 20 years (1993-2012) at an estimated total cost of 18 Milliard EUR. The Baltic Sea JCP is focused on 132 hot spots in the Baltic Sea catchment area, of which 50 were classified as industrial hot spots. In order to assess the progress at hot spots an annual review is carried out by the HELCOM PITF. Finland has the responsibility to coordinate and assess the implementation of measures at the industrial hot spots.

The originally selected industrial hot spots are from various industrial sectors, and their discharges and emissions include various types of pollutants: organic and inorganic substances, chemicals, nutrients, heavy metals, pesticides, SO<sub>x</sub>, NO<sub>x</sub>, dust, suspended solids etc.

The objective of this study is to present a comprehensive review on the progress at the industrial hot spots during 1991-1998. The development in waste water discharges and air emissions are examined for this time period as well as investment activities on environmental projects. All 50 originally selected industrial hot spots are reviewed in order to obtain a comprehensive picture of the development.

The study on industrial hot spots is based on many sources of available material. The most important source has been the annual reporting system based on the Questionnaires on the status of hot spots filled in by HELCOM PITF contact persons in each country and submitted to the lead country each year. Important sources of data have also been the pre-feasibility studies (1991) and reviews of industrial hot spots submitted by Denmark (1994) and HELCOM annual reports (which are based on the questionnaires).

The national reports are not always easy to interpret, and a lot of data needed for the assessment of real progress achieved or of the need for further assistance at the hot spots is lacking. Especially the type, volume and status of local activities remain often unclear. Sometimes it is difficult to assess whether financing is secured or only planned. Locally set time-schedules may also not be realistic. Foreign financial assistance is not always noted in the national reports which may reflect its minor role compared to the need. Based on the reports from the hot spots it is not possible to fully assess the status of compliance with requirements in relevant HELCOM recommendations. This is partially due to shortcomings in the hot spot questionnaires. Nevertheless, the reviews presented certainly give a good overview, as well as details complementing more intuitive judgements.

### Deleted Hot spots

To date, totally 14 industrial hot spots and two industrial sub-hot spots have been deleted from the list. Of these, five are Swedish and five Finnish pulp and paper mills and one is a chemical plant (hot spot number 8), which have been deleted

since they have implemented the pollution prevention and control programs aimed at. Two Estonian hot spots (1 pulp and paper mill and 1 food processing plant) and the pulp and paper mill in Kaliningrad have been removed from the list because they have closed down. Also two Polish industrial plants, which are included in hot spots covering several plants, have closed down.

### **Investment activities**

As regards the investment activities it may be concluded, that out of the 36 remaining industrial hot spots, there is data on investments at 26 plants. Major investments have been implemented at 7 of the hot spots. Five plants have invested between 10-50 % of the estimated investment need, and 6 plants have invested 0-10 % of the investment need. In addition some pre-feasibility studies and environmental programs have been conducted at 7 of the plants, but they have not led yet to real investments. Out of 10 industrial hot spots with no reported investments, 5 are clustered hot spots with various industries and two are mining areas near the Czech and Polish borders.

### **Development in discharges and emissions**

The total reduction of discharges and emissions at the original 50 hot spots has been substantial. The decrease in pollution load is to its major part due to lower production and infrastructure improvements especially in the pulp and paper industry. In the case of AOX, the implemented process and pollution control measures have been the major reason.

The production was reduced significantly at several of the industrial hot spots between 1991-1998. The total waste water flow of all of the present hot spots was reduced by 50 %. At least 11 of the plants, which have reported their waste water flow in 1991 and 1998, have reduced their waste water flow by over 75 %. This indicates a considerable reduction in the production, since none of these 11 plants have invested more than 10 % of the estimated investment need. Waste water flow was moreover reduced by over 50 % at three of the hot spots, of which one had made significant investments. Production has reduced also at some of the hot spots with various industries (at least Riga) and in the oil shale power plants in Narva. It may be concluded, that production has reduced significantly at 15 of the 36 present hot spots.

For all of the original 50 industrial hot spots the reduction of discharges between 1991-1998 has been in total as follows: BOD<sub>5</sub> 70 %, COD 54 %, N<sub>tot</sub> 58%, P<sub>tot</sub> 52%, AOX 83 % and heavy metals 62 %. Air emissions have decreased accordingly, SO<sub>x</sub> by 56 %, NO<sub>x</sub> by 46 %, dust by 58 % and heavy metals by 61 %. The reduction of COD has been even larger at the hot spots still remaining on the hot spot list in the countries in transition (66%), but the reduction of AOX (65 %) has been more moderate compared to the pulp and paper industry in the Nordic countries.

### **Proposed measures**

Although significant progress has been made at industrial hot spots, continued and substantial support will be required to reach the targets of the programme. The possibilities for HELCOM to accelerate pollution control measures at the industrial hot spots are however limited and the main task has been to highlight the most problematic plants and assess their progress. The initiative for finding financial support must come from the industries themselves. Financial matters are often sensitive for the companies and they can be reluctant to submit information and handle these matters with "outsiders" especially if they are in the course of nego-

tiating with possible financiers/buyers. One area where HELCOM PITF might however strengthen its efforts is **increased problem oriented focus**, i.e. paying attention to specific “problematic” hot spots seeking possible financial solutions. A close cooperation should be established between HELCOM PITF (mainly the Programme coordinator) and the contact person in the country in question and the hot spot itself to put together an investment package consisting of possible international funding and the required local share. The prerequisite for this is a wide knowledge of different international financial instruments available for different activities (the Programme Coordinator and the lead country) and local knowledge including sufficient background information on the present situation at the hot spot in question. The application for support would naturally be made by the plant itself and the role of HELCOM would be to give information on financial instruments suitable for this specific activity.

**The issues which HELCOM and especially PITF should address are:**

- **Strengthened reporting** on hot spots. Improved reporting is a prerequisite enabling the Lead Country to assess progress made at the hot spots. There are several hot spots with no or scarce data reported since the reviews made by the consultant. Some modifications to the reporting format are also required to enable assessment of compliance with e.g. industrial HELCOM recommendations. One solution for better reporting could be to report every two years instead of annually. This would give more time to collect more accurate data. The regional hot spot workshops which have been arranged during the past year have been very successful and have facilitated the collection of more accurate data. These workshops are highly recommended to be arranged also in the future.
- **Updating of environmental studies.** So far there has been little activity reported in large industrial area hot spots. The information on these complex industrial hot spots mainly located in Belarus, the Czech, Russia and Poland is scarce, and updated studies should be carried out and efforts for priority action should be strengthened in these areas. Poland has however, conducted a study which examines the situation in Polish hot spots against hot spot criteria. The Polish study also proposes an updating of the present Polish hot spot list. For hot spots in and the upper Neva River basin in the Russian Federation (and for combined industrial and municipal hot spots in Belarus) the initial study had its shortcomings and arrangements for an evaluation could be done by PITF.
- **A clear decision on which sub hot spots are included in the large area hot spots** could be one way out to facilitate improved reporting of discharges and investments for these hot spots. This would also increase attention on special problems within the large hot spots. At the moment the reporting does not cover all the industries identified originally within these areas.
- **Other general solutions.** A work shop in Tallinn had some suggestions to solve the identified problems:
  - 1) Environmental audits should be included in the privatisation process in order to clarify liability questions related to pollution sites and the refurbishment and to assess the level of the price of the site or production plant accordingly.
  - 2) Politicians on both local and national level should be reminded of the commitments related to the Helsinki Convention.
  - 3) Public awareness should be improved and the programme element of Public Awareness and Environmental education should give special attention to the hot spots.

- 4) Project management, enterprise management and operation training should be included in environmental investment projects.
- 5) Regional cooperation between riparian countries should be strengthened.
- 6) Prerequisites for financing should be improved. Financing should be developed by methods recommended by the working group on environmental project financing of EBRD and by the ECE working group of senior governmental officials "Environment for Europe".

# Introduction



## 1.1 Background

An international Baltic Sea Conference at Prime Ministerial Level - the Ronneby Conference - adopted the 1990 Baltic Sea Declaration. The meeting approved principles and priority actions necessary to improve the Baltic Sea environment. An environmental programme was mandated by the high level political representatives from the Baltic Sea region, representatives of financial institutions and observers from non-governmental organisations. They joined to create a programme to "assure the ecological restoration of the Baltic Sea" (HELCOM 1999a).

An ad hoc High Level Task Force within the Helsinki Commission (HELCOM) developed The Baltic Sea Joint Comprehensive Environmental Action Programme (JCP), which was approved in 1992 by the Ministers of the Environment in their Baltic Sea Environment Declaration (HELCOM 1999a). Preparation of the JCP was based on findings and recommendations in a series of national reports prepared by all cooperating countries, field-based pre-feasibility studies conducted on major drainage basins and special regional studies on agricultural run-off and air pollution (HELCOM 1998b).

Key principles of the JCP are to recognise the importance of a long-term perspective for ecological restoration, harmonise economic and environmental objectives, control pollution at the source and establish conditions for private sector participation. The Programme shall be implemented over 20 years (1993-2012) at an estimated total cost of 18 Milliard EUR.

The Programme consists of six elements, which complement each other. The programme's major focus is to reduce point and non point sources of pollution, particularly at the initially 132 (now 115) "hot spots" identified by the JCP. They are mostly of a municipal and industrial nature.

The six components are:

- 1) Policies, Laws and Regulations
- 2) Institutional Strengthening and Human Resource Development
- 3) Investment Activities
  - a) Point-source pollution from municipal and industrial sources.
  - b) Non-point source pollution from agriculture, rural settlements and transportation.
- 4) Management Programmes for Coastal Lagoons and Wetlands
- 5) Applied Research
- 6) Public Awareness and Environmental Education.  
Both preventive and curative measures were emphasised.

It became evident already in the JCP drafting process that one of the major problems to implement the programme would be the mobilisation of financial resources. The 1992 Diplomatic Conference requested for a special conference for mobilising local, national, bilateral and international financial resources to implement the JCP. In March 1993 an International High Level Conference on Resources

Mobilisation was held in Gdansk, Poland. The Conference adopted the Gdansk Declaration which called for efforts to secure financing the implementation of the JCP (HELCOM 1993a).

The HELCOM Programme Implementation Task Force (HELCOM PITF) was established by the Diplomatic Conference in 1992 to initiate, facilitate and monitor co-ordination of the implementation of the JCP and to periodically update the Programme.

HELCOM PITF members and observers consist of different types of parties and organisations, the partnership and co-operation of which made the success possible. HELCOM PITF consists of representatives of the Contracting Parties to the Helsinki Convention (Denmark, Estonia, European Community, Finland, Germany, Latvia, Lithuania, Poland, Sweden and Russia); representatives of Belarus, Czech Republic, Norway, Slovak Republic and the Ukraine; representatives of international financial institutions (CEB, EBRD, EIB, NEFCO, NIB, and World Bank) and the International Baltic Sea Fishery Commission; as well as representatives of observer organisations (particularly CCB, CRE, EUCC, ICLEI, INEM, UBC and WWFA). Comprehensive membership makes HELCOM PITF very flexible and safeguards the feedback between basic work on different levels and HELCOM PITF.

At the Baltic Sea States Summit (Visby, Sweden, 1996), the Heads of Governments expressed the opinion that JCP should be updated and strengthened and the pace of implementation accelerated.

At HELCOM PITF 9 (2-4 October 1996, Hel, Poland) a project on updating and strengthening of the JCP was established. It was to identify deficiencies and shortcomings in the implementation process of the Programme and to make proposals on how to adjust the JCP to the changed political, economical, environmental and other conditions. The Project was finalised in February 1998 and the Special meeting of HELCOM PITF (February 1998) adopted the final report "Recommendations for Updating and Strengthening". The ministers joined in the Recommendations in HELCOM 19 in March 1998.

The Baltic Sea JCP is focused on 132 hot spots in the Baltic Sea catchment area, of which 50 are classified as industrial hot spots. In order to assess the progress at hot spots an annual review is carried out by the HELCOM PITF. Finland and Sweden have the lead party responsibility for the Point Source Pollution element of the JCP. Finland takes the responsibility to co-ordinate implementation of measures at industrial hot spots while Sweden's responsibility covers combined municipal and industrial waste water treatment.

## ***1.2 Political and economical development in the Baltic Sea Region***

This chapter describes shortly the political and financial development in the Baltic Sea region, which also largely affects the progress of environmental projects at industrial hot spots in the area. The content of this chapter is mainly based on the report Recommendations for updating and strengthening (HELCOM 1998b).

### ***1.2.1 Political and economical changes in the 90's***

The state of the marine environment of the Baltic Sea is closely linked to the major political and economic events occurring within and among the countries of the Baltic Sea region. Since the Baltic Sea Declaration at Rönneby in 1990, most of the countries of the region have undergone considerable changes in political and economic structure. Germany's reunification, the end of centrally planned economies

in many countries, the accession of Sweden and Finland to the EU, and now the accession efforts of the Czech Republic, Estonia, Latvia, Lithuania, Poland and Slovak Republic, are examples of significant structural change. A series of changes stand out as especially relevant to PITF efforts:

Most of the national governments of the region have entrusted greater authority and responsibility for environmental management to local government. Decentralisation and local empowerment hold out hope for improved environmental protection efforts, if the challenges to build up local financial and technical capabilities can be met.

A trend of significance to the region has been the strengthening of the private sector in the countries in transition in all areas -industry, agriculture, services, and land ownership. The change in the role of government, from producer of goods to regulator of private production, has direct implications for the environmental management efforts of these governments, requiring increased attention on enforcement and permitting programmes.

The EU has taken an important role in establishing guidelines for environmental management throughout much of the region, resulting in a focus on harmonisation of national environmental laws and practices in the countries concerned. This harmonisation process has created significant opportunities for expanded dialogue between countries on their approaches to environmental policies, regulations and institutions.

In the early years of the 1990's the region was in the middle of economic recession. The countries in transition (Belarus, the Czech Republic, Estonia, Latvia, Lithuania, Poland, the Russian Federation, Slovak Republic and Ukraine) all experienced severe economic problems as they began the painful transition into market based economies. Overall economic development, as indicated by Gross Domestic Product (GDP) and rates of economic growth, decreased sharply in the beginning of the transition for these countries, and has only increased in recent years, particularly in Estonia and Poland. The annual GDP of most of the countries in transition remains at or below 1990 levels. Several of the EU member countries likewise experienced economic recession in the early 1990s, including Finland and Germany, and to a lesser extent Sweden. While the EU countries have staged economic recoveries since then, unemployment rates remain high. Given the direct relationship between general economic well being and support for environmental management measures, regional economic difficulties pose a continuing challenge for Baltic Sea environmental efforts.

### ***1.2.2 Industrial production in the 90's***

There has been a decrease in industrial production, which fell off significantly in the countries in transition in the beginning of the 90's, and has only recently begun to pick up again. Some of the largest facilities were shut down due to financial problems, which were often relating to lack of raw material or decreased demand for products. Both plant closings and pollution control upgrades have contributed to a decrease in organic pollution and to some extent also in nutrient pollution from these sources.

There has been an expansion in the number of small and medium size enterprises, which has been considerable in the countries in transition. These industries have been important in driving economic growth at the national and local level and have been responsible for a very high percentage of job creation. These industries also present significant new challenges for environmental management, due to their scale, diversity and distribution.

The governments in the eastern and southern parts of the region made major changes in their energy use. There has been introduction of significant price reforms for all types of users, adoption of energy conservation measures, conversion to cleaner fuels and in some countries considerable restructuring of the energy sector. Major reductions in energy use have occurred in the countries in transition due to adoption of new energy policies, including market oriented prices. These countries have also made investments in new and modern facilities for improved energy efficiency, and have introduced measures for reduction of air pollution in energy generation, district heating and industry.

In the energy producing industrial plants new requirements have been introduced and the costs are higher. New air pollution control requirements, which are driven by EU directives, are likely to affect the cost of power production, leading to higher consumer energy prices. National target programmes and international agreements for reducing CO<sub>2</sub>, and other greenhouse gas emissions will also influence the structure and location of power production. Greenhouse gas reduction limits will be established under the United Nations Framework.

# Objectives and methods of the study

# 2

## 2.1 Objectives

The objective of this study is to present a comprehensive review on the progress of the industrial hot spots during 1991-1998. The development in waste water discharges and air emissions have been examined for this time period as well as investment activities on environmental projects. All 50 originally selected industrial hot spots are reviewed in order to obtain a comprehensive picture of the development.

The first part of the study deals with the development of industrial hot spots as a whole and by countries (chapter 3). The second part includes a detailed description of industrial hot spots by catchment areas (chapter 4). The third part of the review includes a brief look at industries by sectors (chapter 5). The last part of the study summarises the main obstacles impeding the implementation of environmental activities on hot spots, and proposes some solutions to ease the problems (chapter 6).

## 2.2 Methods

The study on industrial hot spots is based on many sources of available material. The most important source has been the annual reporting system for hot spots based on the "Questionnaire of Status of JCP Hot Spots". The questionnaires are filled in by HELCOM PITF contact persons in each country and submitted to the lead country each year. Other important sources of data have also been the pre-feasibility studies (1991) and industrial hot spot reviews conducted by Denmark (1994), HELCOM annual reports and activity inventories (1992-1999), Baltic 21 series (6/98), Swedish Lead Party Report on Combined and Municipal waste (1996) and Baltic Sea Environment proceedings No. 46-71 (1993-1998). Also some official WWW-pages have been used to obtain updated valid data. In cases of lacking data in the JCP questionnaires and annual reports, the data from preliminary studies has been used. For Finnish hot spots also some other data have been attained from earlier studies of the Finnish Environment Institute (FEI). References to other than HELCOM sources are indicated. If sources are not mentioned, the used data is from annual reports, Hot Spot questionnaires or activity inventories 1993-1999.

During 2000-2001 regional PITF workshops on hot spots have been arranged in several of the countries in transition. It was not possible to include all of the valuable information presented at the workshops due to the fact that the data used for this report was compiled during the summer in 2000.

## 2.3 Comments on data collection and calculations

For some hot spots it has not been possible to obtain essential data. Efforts to gather some replacement data have been made. The vast deficiencies in reporting together with the wide variety of industries among the hot spots with different

kinds of problems makes it difficult to draw conclusions on both pollution load trends and investments for the whole sector (or sub sectors). Verified conclusions can only be drawn for individual hot spots with sufficient reporting. An effort to summarise the situation for the whole industrial sector (as well as sub sectors) has however been made in order to get some kind of picture of where we are at the moment.

- 1) Hot spot questionnaire reports have been lacking or the data has been inaccurate for several of the hot spots. Especially data from the hot spots with various industries have been insufficient or lacking. For some industrial plants no data has been received since 1994. Hot spots No. 43 (LV), 108 (PL), and 111 (PL/CS) have not delivered any data since 1995. Hot spot 102 (PL) has delivered deficient data due to its unclearly defined sub-hot spots. Three of the hot spots with deficient data were classified as priority hot spots with large environmental effects on the catchment area. There has been a general problem of unclearly defined sub-hot spots in areas with various industries and Poland has made a suggestion for the revision of the hot spot list. Poland has delivered data on some of the industries, which they consider as sub hot spots. Because of missing data it is obviously not possible to assess the success of environmental projects as a whole. For the hot spots with various industries, the reported data has been used.
- 2) Data on some pollutants may be missing from the hot spot reports. Many of the plants have reported discharge data only on parameters for which it was originally selected as a hot spot (minimum reporting), even though also other pollutants could be essential from an environmental point of view. The summaries of waste water discharges and air emissions are therefore only trend setting and do not represent the real total pollution load for every pollutant parameter from all industrial hot spots.
- 3) The reasons for the development of discharges and emissions can not always be assessed. This is partly due to shortcomings in the hot spot questionnaires, through which the data is gathered. The volume of production is not asked for, and it is not always possible to estimate the development only based on data on waste water flow, since reduced waste water flow may indicate either reduced production or reduced use of water (i.e. better recycling of wastewater in industrial processes). In this report it is assumed that the reduced waste water flow indicates reduced production if no relevant pollution control projects have been reported.
- 4) Compliance with limit value requirements of HELCOM recommendations can not always be estimated due to insufficient data on waste waters and pollutants. Often cooling, process and other waste waters are reported jointly without differentiation, whereas limit values in HELCOM recommendations for different sectors apply for process waste waters only. Comparison with HELCOM recommendations is also difficult due to the fact that, as mentioned above, plants do not always report on all pollutants even if they are measured. Compliance with HELCOM recommendations is, however, one of the most important criteria for hot spot deletion.
- 5) The methods used for measuring discharges, emissions and waste water flow at industrial hot spots vary and the reported figures are not always comparable. Uniform methods for measurement would be necessary to enable comparison of pollution loads.

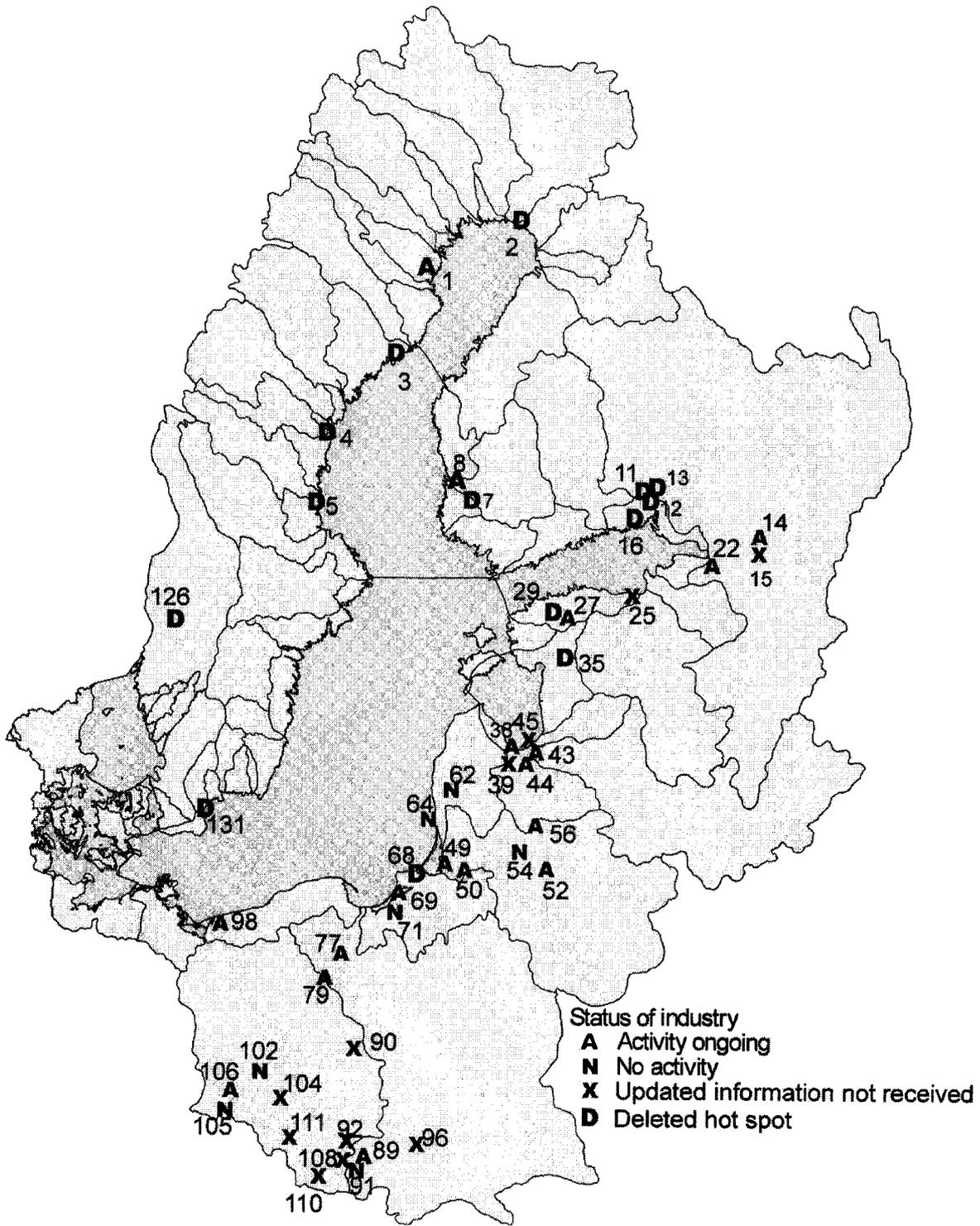


Figure 3.1. Map of industrial hot spots and ongoing investment activities on them in 1998. Hot spot locations are indicated by letters; next to the letter is the hot spot's number (1 to 50).

# 3

## Summary on industrial hot spots Calculation methods in this report

**Reported discharges** are mainly based on data from hot spot questionnaires, annual reports and activity inventories. Also general background information on industries and total discharge and emission figures on priority hot spots from the Danish hot spot reviews (1994) have been used. The Danish reviews from 1994 on priority hot spots cover the years 1990-1994.

**Future discharges** for hot spots which have secured financing are calculated based on reported estimated pollution loads after the planned actions have been implemented. The time frame for these future discharges may vary. If no future actions are planned the discharges and emissions are expected to stay at same level as in the year of the last reporting (usually -98).

**The HELCOM-discharges** are calculated by using the reported waste water flow (if process waste waters are reported) or production volume (pulp and paper industry) and limit values in HELCOM recommendations for different sectors of industry. These are examined more precisely in chapter 5, where the different sectors of industries are evaluated. HELCOM-discharges are used only for the hot spots that have reported their process waste water flow or production. In cases of missing flow data the latest reported flow is used.

### 3.1 Types and location

There were originally 132 hot spots selected by HELCOM in 1992, of which 50 were classified as industrial hot spots. There are also other industrial plants included in the JCP, which are handled under the point source pollution element for combined industrial and municipal hot spots with Sweden as lead country (See "Swedish Environmental Protection Agency 1996). All originally selected, 50 industrial hot spots, both existing and deleted, are evaluated in this report to get a comprehensive picture of the overall development of discharges and emissions from the whole sector of industrial hot spots.

Table 3.1. Number of industrial hot spots in the countries located on the Baltic Sea catchment area.

Country	Current industrial hot spots (priority included)	Current industrial priority hot spots	Deleted industrial hot spots
Finland	1	0	6
Sweden	1	0	5
Estonia	2	1	2
Latvia	5	2	0
Lithuania	5	0	0
Russia	7	2	1
Poland	13	3	0
Czech	1	1	0
Poland/Czech	1	0	0
Total	36	9	14

The originally selected hot spots represent various industrial sectors and their discharges and emissions include various types of pollutants: organic and inorganic substances, chemicals, nutrients, heavy metals, pesticides, SO<sub>x</sub>, NO<sub>x</sub>, dust, suspended solids etc.

## 3.2 Discharges and emissions

### 3.2.1 Waste water flow at present industrial hot spots

The development of the volume of untreated, partly treated and fully treated waste waters (complying with limit values of relevant HELCOM Recommendations) based on reported data are shown in figure 3.2. Future figures are estimated pollution loads at hot spots with secured financing, after the planned actions have been implemented. If no changes in flows are reported the flow is estimated to be same as in previous year. The data is from current industrial hot spots (36 hot spots) with available waste water flow data. If production has stopped the flow is estimated to be 0. There are some problems with reported waste water flows: for some plants the flow is not reported and in some cases it is not possible to estimate what the treated, partly treated or untreated waste water contains (if cooling waters are included). The reported waste water flow should be divided at least into cooling and process waters.

It is obvious that the reported total waste water flow has reduced considerably between 1991-1998. This is mainly due to reduced production, especially in the countries in transition. There has also been some progress in production processes, like increased water recycling in some plants. Several of the hot spots have been deleted from the hot spot list after the production has stopped; in some plants the production has also stopped temporarily. The share of treated waste water has increased compared with untreated waste waters.

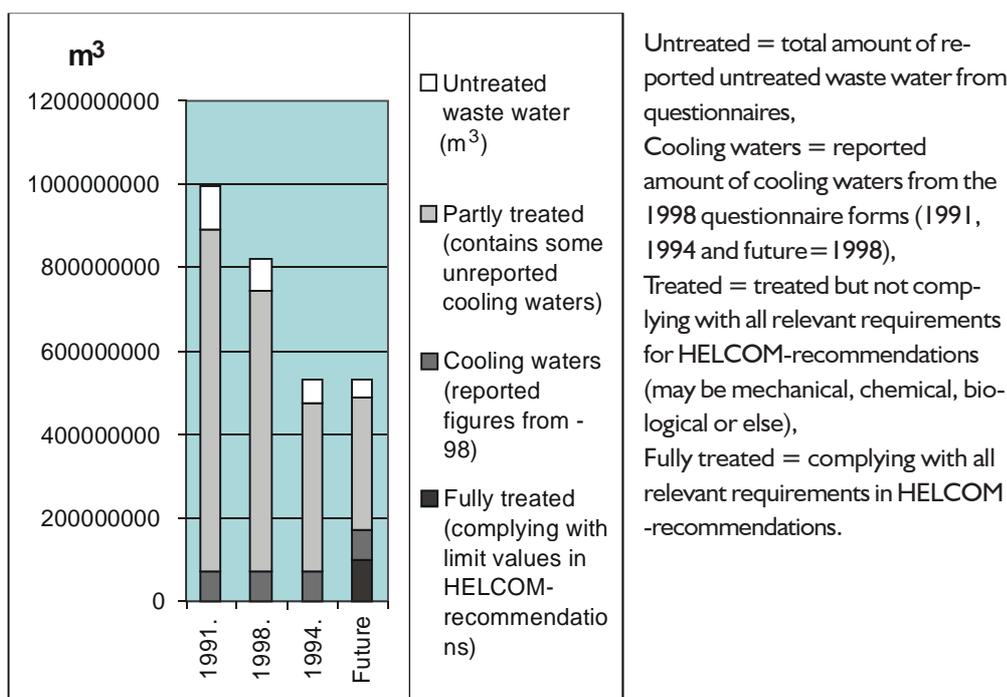


Figure 3.2. Treatment of waste water from industrial hot spots (m<sup>3</sup>, deleted hot spots not included).

### 3.2.2 Summary of discharges and emissions from industrial hot spots between 1991-1998

The discharges of BOD<sub>5</sub> and nutrients were reduced significantly, partly due to reduced production and partly also due to reduction achieved by environmental projects. Between 1991-1998 the waste water flow was reduced by 43 % and the content of pollutants in the waste waters even more: BOD<sub>5</sub> by 76 %, P<sub>tot</sub> by 72 % and N<sub>tot</sub> by 60 %. This may indicate also some success in environmental projects. For chlorinated substances (AOX) and chemical oxygen demand (COD) the reduction has been even larger.

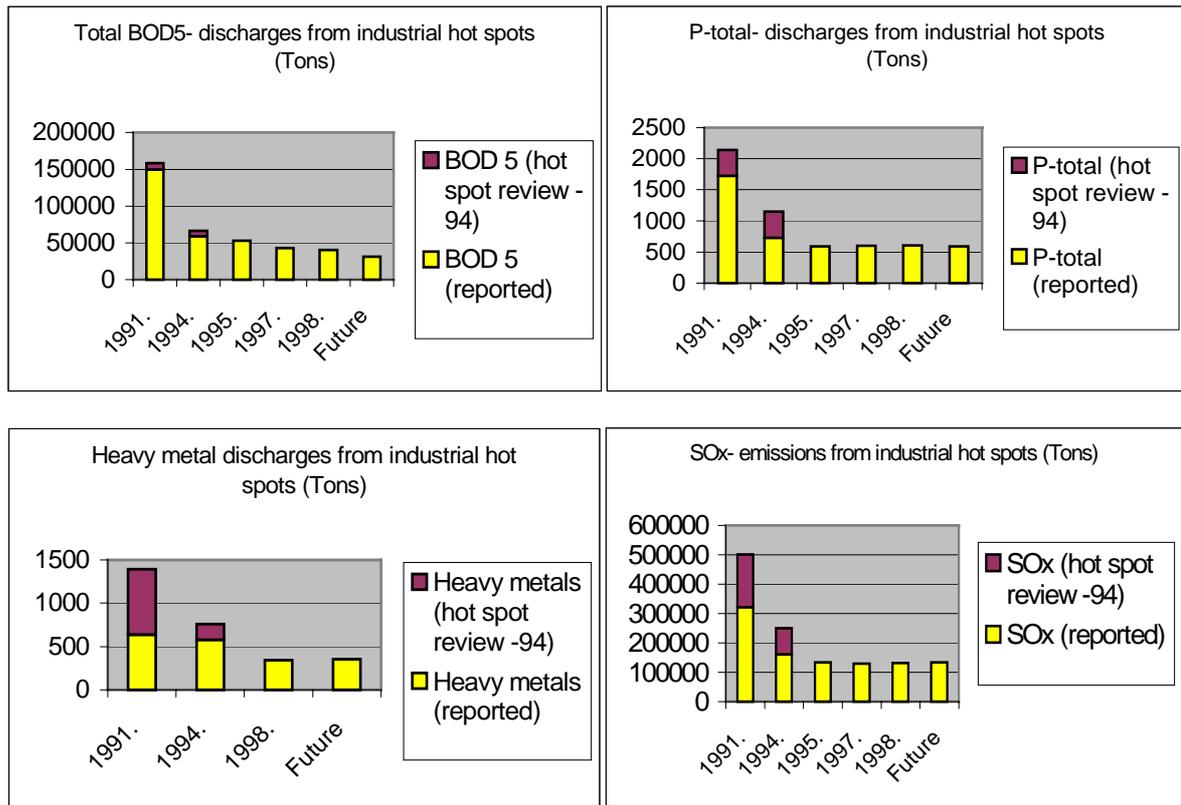


Figure 3.3. Waste water discharges (BOD<sub>5</sub>, P and heavy metals) and air emissions (SO<sub>x</sub>) from industrial hot spots (in tons). (As some figures of discharges and emissions of hot spot review (1994) differ considerably from figures in annual reports, both figures are shown. The difference is mainly caused by the area hot spots with multiple industries. See section 2.3).

### 3.3 Investments

Investments made and planned investments with secured financing at industrial hot spots since 1991 are presented in figure 3.4. The investments are shown for priority hot spots, deleted hot spots and other industrial hot spots, and they are compared with the estimated costs to reach the target of the JCP.

Some of the investments made in earlier years may be missing from the figure if they have not been reported. The figures on investments made at those industrial plants, which were deleted from the hot spot list due to reduction in discharges and emissions are the same as the original estimated investment need figures. This refers mainly to Finnish and Swedish pulp and paper mills.

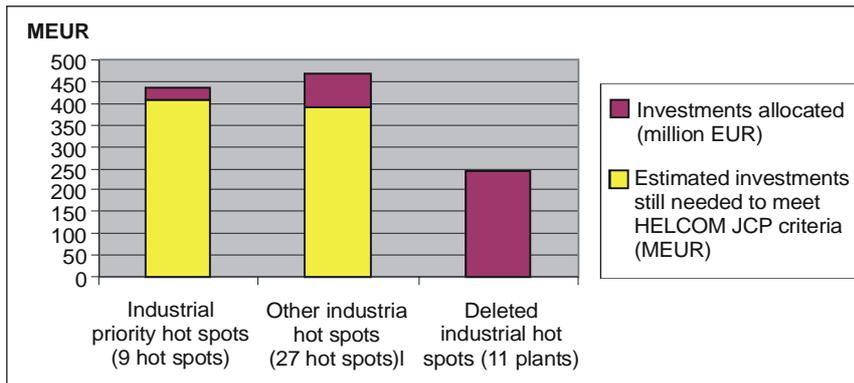


Figure 3.4. Reported allocated investments on industrial priority hot spots, deleted hot spots and other hot spots (cost estimates from 1994).

It is obvious that more investments have been allocated on other industrial hot spots than priority hot spots. This is understandable, since priority hot spots are often quite old with a considerable reconstruction need, while other hot spots require less investments (see chapter 6).

### 3.4 Development of investments country by country

In this section the development of the financial status of industrial hot spots is considered country by country. Reported allocated resources have shown to be either investments already made or future allocations with secured financing. Also cost estimates to meet the target of JCP are shown if defined. For deleted hot spots only the original cost estimate is shown. These figures are based on hot spot questionnaires, and may lack some data on previous investments made because they are not always reported.

#### 3.4.1 Finland

Hot Spot No.	Country	Name	Environmental Investment Activity
2	Finland	Metsä-Botnia OY Kemi pulp and paper mill	DELETED -94 (cost estimate 18 MEUR)
7	Finland	Outokumpu Harjavalta metals	YES, 4,4 of 4,7 MEUR allocated
8	Finland	Kemira OY Vuorikemia (chemical)	DELETED -98 (cost estimate 21 MEUR)
11	Finland	YPT Joutseno pulp and paper mill	DELETED -94 (cost estimate 45 MEUR)
12	Finland	Kaukas Lappeenranta pulp and paper mill	DELETED -94 (cost estimate 28 MEUR)
13	Finland	E-G Kaukopää pulp and paper mill	DELETED -94 (cost estimate 46 MEUR)
16	Finland	Sunila OY Kotka pulp and paper mill	DELETED -97(cost estimate 16,4 MEUR)

Most industrial hot spots in Finland have implemented the required measures for deletion from the list of hot spots and there is only one left out of 7 originally on the list, Outokumpu Harjavalta Metals. Between 1991-1998 the waste water discharges have been reduced considerably, COD by 70 % and AOX by 93 %. Only domestic resources have been invested on hot spots.

Almost all of the estimated investments (cost estimate was originally 179 MEUR) have been allocated to reduce discharges and emissions of hot spots.

Ongoing or finished activities 1991-98:

- Outokumpu Harjavalta Metals (Hot spot No. 7): pollution control measures include increased waste water treatment capacity, building of a new electrostatic precipitator for the copper smelter and improvement of bag filters. 4,4 MEUR have been allocated from the company's own budget, with an estimate of project duration until 1999. The company has invested a lot more on processes which are not regarded as environmental investments, although the improvements have an impact on emissions. The plant has reduced its discharges and emissions considerably even when production has increased significantly. There have been some problems with the functioning of the installed bag filters.

### 3.4.2 Sweden

Hot Spot No.	Country	Name	Environmental Investment Activity
1	Sweden	Rönnskärsverken (metal smelter)	YES, 45 of 45 MEUR allocated
3	Sweden	Husum Kraft pulp and paper mill	DELETED -94 (cost estimate 12 MEUR)
4	Sweden	Östrand pulp and paper mill	DELETED HOT SPOT -94 (no cost est.)
5	Sweden	Vallvik pulp and paper mill	DELETED HOT SPOT -94 (no cost est.)
126	Sweden	Skoghall pulp and paper mill	DELETED -94 (cost estimate 40 MEUR)
131	Sweden	Nymölla pulp and paper mill	DELETED -96 (cost estimate 18 MEUR)

In Sweden there were originally 6 industrial hot spots on the hot spot list. Five of them, all pulp and paper mills, have been deleted from the hot spot list after a substantial reduction in waste water discharges. Between 1991-1998 the discharges of AOX in Swedish original hot spots have been reduced by 85 % and COD by 50 %. Also discharges of  $N_{tot}$ ,  $P_{tot}$  and  $BOD_5$  have been reduced considerably (by 30-40 %). The only hot spot left is the large metal smelter Rönnskärsverket. Only local resources have been invested on hot spots in Sweden.

Ongoing or finished activities 1991-98:

- Rönnskärsverket (Hot spot No. 1) has an enlargement of production under way, the production of copper is planned to increase by 115 %. Project budget is not available.

### 3.4.3 Russia

Hot Spot No.	Priority	Country	Name	Environmental Investment Activity
14		Russia	Syastroi pulp and paper mill	YES, 1,14 of 34 MEUR allocated
15		Russia	Volkhov aluminium plant	YES, 1,6 of 2,8 MEUR allocated
22		Russia	300 Metalplating plants in St. Petersburg	Technical Assistance ?
49	X	Russia	Sovetsk pulp and paper mill	YES, 25,6 of 64 MEUR allocated
50	X	Russia	Neman pulp and paper mill	YES, 1,1 of 7,3 MEUR allocated
68		Russia	Kaliningrad Pulp & Paper No. 1	DELETED -98 (Production stopped)
69		Russia	Kaliningrad p&p mill No. 2	YES, 0,9 of 1,4 MEUR allocated
71		Russia	Kaliningrad Oil Bunkering Station	NO, Lack of Funds

Originally there were eight industrial hot spots in Russia. The waste water load from Russian hot spots has reduced considerably between years 1991-1998: a 93 % reduction of  $N_{tot}$  discharges and a 70 % reduction of  $P_{tot}$  discharges. Also air emissions of  $SO_x$  and  $NO_x$  have been reduced by 15-22 %. This is to some extent due to the implementation of measures, although the most important reason is reduced production. The waste water flow from industrial hot spots was reduced by 89 % in the same period.

A total amount of 30,4 MEUR has been allocated for industrial Russian hot spots of the total estimated need of 313 MEUR to meet the original target of the JCP.

Ongoing or finished activities 1991-98:

- Syasstroi pulp and paper mill (No. 14), has allocated 1,14 MEUR on water pollution control and waste management. Projects include 1) reconstruction of pulping plant with replacement of boilers, 2) washing of vehicles and 3) reconstruction of power stations.
- Volkhov aluminium plant (No. 15) has allocated 1,6 MEUR on environmental projects. The projects include an environmental assessment and technical design of 1) reconstruction of super phosphate and sulphate units, 2) reconstruction of furnaces and 3) reconstruction of cement plant.
- In several metal plating plants in the St. Petersburg area (No. 22) technical assistance and investments have been reported. Assistance is coming from Danish, German, and local sources. Projects include assessment of pollution, a federal programme for reconstruction of several galvanic plants between 1995-2001 and waste management projects for galvanic and aluminium wastes.
- Sovetsk pulp and paper mill (No. 49) has invested 25,6 MEUR on water pollution control, which includes the construction of an external biological WWTP for effluents from both the municipality and the mill (a total capacity of 169000 m<sup>3</sup>/day). The construction stopped in 1996 due to lack of centralised funding.
- Neman pulp and paper mill (No. 50) has allocated 1,1 MEUR for the construction of a combined biological WWTP for waste water both from the town of Neman and the company (total capacity of 95 000 m<sup>3</sup>/day). The construction has stopped due to lack of centralised funding.
- Kaliningrad pulp and paper mill No. 2 (No. 69) has invested 0,9 MEUR in the re-construction of the internal sewage system and the plant's own WWTP as well as in the connecting of its waste waters to the combined biological WWTP for the municipal waste waters of the city of Kaliningrad and local industries. The project is estimated to be finished by 2000.

### 3.4.4 Estonia

Hot Spot No.	Priority	Country	Name	Environmental Investment Activity
25	X	Estonia	Narva, oil shale power plant	YES, consulting (cost estimate 225 MEUR)
27		Estonia	Kehra p&p mill	YES, 0,329/0,7 MEUR allocated
29		Estonia	Tallinn pulp and paper mill	DELETED -94 (Production stopped)
35		Estonia	Vohma meat combine	DELETED -97 (Production stopped)

There were originally four industrial hot spots in the republic of Estonia. Most of the reduction in discharges at the industrial hot spots between 1991-1998 is due to stopped production at two hot spots. These two plants have been deleted from hot spot list. The oil shale power plant in Narva has also reduced its production considerably.

Ongoing or finished activities 1991-1998:

- Narva oil shale power plants (No. 25) have installed several electronic precipitators on boilers. A replacement of existing boilers with modern boilers to reduce SO<sub>x</sub>-emissions substantially is planned. There are plans to privatise the plant. Environmental programmes are partly planned with Finnish consultants and are supported by Finland and NIB.
- Kehra pulp and paper mill (No. 27) has allocated 0,7 MEUR (0,3 MEUR already invested) on 1) Water pollution control: reconstruction of wastewater aeration system(completed) 2) Air pollution control: reconstruction of the electrostatic precipitator (completed) 3) Waste management -construction of boiler (ongoing). Financing is coming from the company's own resources and Swedish donors.

### 3.4.5 Latvia

Hot Spot No.	Priority	Country	Name	Environmental Investment Activity
38	X	Latvia	Sloka pulp and paper mill	Privatisation ongoing, production ceased
39	X	Latvia	Olainfarm (pharmaceutical)	Privatisation ongoing by 2001
43		Latvia	VEF plant (metal industry)	Privatisation ongoing by 2001
44		Latvia	RER plant (metal industry)	Privatisation ongoing by 2001
45		Latvia	Various industries	MISSING DATA (Production reduced)

The total waste water discharges have significantly reduced in the five Latvian Hot Spots between 1991-1998. The reduction is partly due to the new waste water treatment plant in Riga completed in 1992 and partly to the general regression in industrial activities (Swedish... 1996).

Most of the industrial plants are in the "BEAROP II phase" between 1999-2001, which means that the plants are being privatised.

Ongoing or finished activities 1991-98:

- Privatisation of the Latvian industrial hot spots is ongoing and is expected to be finalised by 2001, but there is no accurate data on implemented environmental projects in the plants. In 1996 an environmental project of VEF galvanotec (No. 43) was planned by a Danish consultant with Danish support, and also RER galvanotec (No. 44) had an environmental study ongoing.

### 3.4.6 Lithuania

Hot Spot No.	Country	Name	Environmental Investment Activity
52	Lithuania	Jonava Azotas fertiliser plant	YES (technical ass.), NO invest. (35 MEUR)
54	Lithuania	Kadainiai fertiliser plant	MISSING DATA
56	Lithuania	Panevezys food proces.industry	YES, 0,17/0,17 MEUR allocated
62	Lithuania	Mazeikiai oil terminal	NO
64	Lithuania	Klaipeda cardboard factory	NO PRODUCTION (cost est. 30 MEUR)

There are five Lithuanian industrial hot spots on the hot spot list. The production has been significantly reduced (80 %) between 1991-1998 in many plants. The waste water discharges have been reduced by more than 80 %. This indicates clearly that the reduction is mainly due to reduced industrial production.

Ongoing or finished activities 1991-98:

- In Janova Azotas fertiliser plant (No. 52) an investigation on water pollution control has been conducted supported by USAID.
- In Panvezy's food processing industry (No. 56) investments of 170 000 EUR have been allocated. An environmental review of the plant supported by Denmark has been conducted.

### 3.4.7 Poland

Hot Spot No.	Priority	Country	Name	Environmental Investment Activity
77		Poland	Frantschach Swiecie S.A. p&p mill	YES, 4,1 of 4,1 MEUR allocated
79		Poland	Bydgoszcz "Kapusciska"(chem.)	YES, 45 of 45 MEUR allocated
89		Poland	"Organika-Azot" in Jaworzno (chem.)	YES, 0,6 of 0,8 MEUR allocated
90		Poland	"Boruta" in Zgierz(Dye stuffs)	YES, 16,8 of 18 MEUR allocated
91		Poland	Oswiecim- "Dwory" (Chemical)	YES 1991-94, 21MEUR invested?
92		Poland	"Boleslaw" in Bukowno (Metals)	YES, 1,6 of 3,3 MEUR invested?
96		Poland	Upper Vistula River basin (Salt control)	MISSING DATA (cost estim. 0,3 MEUR)
98	X	Poland	Szczecin (fertiliser, food)	YES, 0,02 of 2,1. MEUR allocated
102	X	Poland	Legnica-Glogow, various industries	NO, lack of funds (cost estim. 108 MEUR)
104		Poland	Wroclaw (chemical, food & textile)	MISSING DATA
105		Poland	"Ubocz" (fertiliser)	NO,lack of funds (cost estim. 0,8 MEUR)
106		Poland	Boleslawiec - "Wizow" (fertiliser)	YES, 0,01 of 0,8 MEUR allocated
108	X	Poland	Katowice-West, various industries	MISSING DATA (cost estim. 8,8 MEUR)
111		CS/Poland	Upper Odra River basin (Salt control)	MISSING DATA

Originally there were 13 industrial hot spots in Poland. The waste water discharges have been reduced considerably, the amount of BOD<sub>5</sub> was reduced by 45 %, N<sub>tot</sub> by 24 %, COD, P<sub>tot</sub> and metals by about 50 %. Air emissions of SO<sub>x</sub> and NO<sub>x</sub> have been reduced by about 50%. A great part of the reduction is due to successful environmental projects although reduced production contributes significantly to the reduction of the pollution load. Two industrial sub-hot spots in the areas with various industries were deleted from the hot spot list after they were closed down.

A total of almost 66 MEUR was allocated by 1998 to Polish industrial hot spots, while the total cost estimate to meet HELCOM-JCP criteria was 217 MEUR.

Ongoing or finished activities 1991-98:

- Frantschach Swiecie S.A. pulp and paper plant (No. 77) has completed a modernisation of the biological WWTP, and investments of 3,4 MEUR were incurred by 1998. An estimated amount of 0,7 MEUR remained to be invested. A modernisation of causticisation was implemented between 1991-94 with support from Finnish donors and Finnish consultants. From 1999 waste waters are treated biologically and chemically. All was funded from the plants own resources.
- Bydgoszcz chemical plant (No. 79) has a water pollution control project ongoing, with a mechanical and biological WWTP under construction. The WWTP Kapusciska is processing both industrial waste water as well as communal waste water from Bydgoszcz city. It might be more relevant to include this hot spot under the combined municipal and industrial element

with Sweden as lead country. It has an estimated project duration until 2000. A sum of 6,4 MEUR has been allocated and incurred by 1998. An amount of 39 MEUR remains to be invested. A total of 45 MEUR is financed from own resources (12,8 MEUR) and the rest by the Eco Fund (4,2 MEUR), Loans from the National fund for Environmental Protection and Water Management (20 MEUR), Loans from Provincial Fund for Environmental protection and Water Management (4 MEUR) and by trade credits etc (6,3 MEUR).

- Organika-Azot chemical plant in Jaworzno (No. 89) has invested on water pollution control, air pollution control and waste management : 1) the modernisation of waste treatment technology, 2) the modernisation of the production line on insecticides 3) the elimination of use of chlorine and 4) the modernisation of the landfill. All projects are estimated to be completed by 2001. A sum of 0.23 MEUR has been invested by the end of 1998, and 0.38 MEUR of own capital has been allocated on the project mentioned in point 2).
- "Boruta" Dyestuffs Plant in Zgierz (No. 90) has invested on water pollution control. A full scale construction of the plant's facilities was ongoing in 1998, with an estimated project completion by 1999. The project budget of 18 MEUR (17 MEUR invested by 1998) was financed with a 7,6 MEUR loans from the National Fund for Environment protection and Water Management, a 1,8 MEUR loan from Voivodship Fund for Environmental Protection and Water Management, a sum of 0,035 MEUR from the municipal fund for environmental protection, 1,7 MEUR from the Central Government, 2,25 MEUR from Zgierz city funds, 1,2 MEUR from the company's own capital, 0,5 MEUR from the Voivodship fund for environmental protection and Water Management and 0,9 MEUR from the "Czysta Bzura" foundation.
- Oswiecim - chemical plant "Dwory" (No. 91). An inventory in 1992-94 was conducted supported by Finland (HELCOM PITF 10/97). A set of remedial actions were taken in the period 1991-1994, which included 1) equipping the heat generating plant with electrostatic precipitators 2) construction of a landfill 3) construction of a new waste water treatment plant with sludge dewatering, with costs of 20.1 MEUR (HELCOM PITF 7/95) (costs have not been reported on JCP questionnaire).
- Mining and Metallurgic Works "Boleslaw" in Bukowno (No. 92) had projects on water pollution control ongoing in 1997: 1) protection against clean water pollution connected with mines closure, 2) a programme of water treatment in the lower part of the mine (settling tank construction) and 3) monitoring of underground and surface water. Also projects on air pollution control were ongoing: 1) a modernisation of the zinc oxide plant, 2) a modernisation of the zinc electrolysis department and 3) the prevention of secondary emissions from settling ponds. The time schedule for the finalisation of the project is by 2000. Investments on pressure filters have been made (1992, supported by Finland) and a refurbishment was made between 1990-97 with Swedish equipment. Investments of 1,6 MEUR were estimated to be allocated by 1996 (HELCOM PITF 7/95).
- The Coal mining areas in the upper basins of Vistula (No. 96) are conducting a salt control inventory, and actions are planned to be finalised by 2005.
- Szczecin industrial (No. 98) has invested on environmental projects. At the chemical plant "Police" there are several investments ongoing or completed in the plant. **Ongoing:** 1) the construction of a conveyor belt for salt transport, 2) the desulphurisation of gases to reduce SO<sub>x</sub>-emissions, 3) the reuse of FeSO<sub>4</sub>. **Completed:** 4) shifting from the use of coal powered fuel burners to low emission burners to reduce NO<sub>x</sub> and dust emissions 5) continuous monitoring of the heat power plant. **Planned:** 6) automation of immission

stations 7) new piezometers for the FeSO<sub>4</sub> dump. Investments were not reported. An environmental project is also ongoing in the pulp and paper mill "Szczecin-Skolwin" S.A.: 1) construction of a biological WWTP for municipal and industrial waste waters and 2) construction of a new boiler. A sum of 0,02 MEUR has been allocated and about 2 MEUR is planned to be invested. The remaining needed investments are planned to be financed by foreign funds (0,18 MEUR), the central and local government (1,12 MEUR from National Fund for Environmental Protection and Water Management, Provincial fund for environmental protection and water management) and by own resources (0,7 MEUR).

- Legnica-Glogow area (No. 102) has several industrial plants in the area, but due to lack of funds there are no environmental projects ongoing.
- Wroclaw area (No. 104) has an environmental programme defined which is planned to be implemented by the year 2000 by local investments.
- Fertiliser plant "Ubocz" (No. 105) had some water pollution control projects and technical design implemented in 1997.
- Boleslawiec - Chemical plant "Wizow" (No. 106) has made some minor investments on water pollution control (prefeasibility study ongoing). 8 500 EUR were allocated by 1998 with a total estimated budget of 0,5 MEUR by 2000.
- Katowice-West industrial area (No. 108) has not reported on the investments in the area.
- Upper basin of Odra river (No. 111) is a mining area located in both Czech and Polish territory, but there is no data on investments on environmental projects in the area.

### 3.4.8 Czech

Hot Spot No.	Priority	Country	Name	Environmental Investment Activity
II0	X	Czech	Ostrava area, various industries	MISSING DATA (cost estimate 35 MEUR)
III		CS/Poland	Upper Odra River basin (salt control)	MISSING DATA

One area located in Czech and one area located in both Czech and Polish territory were selected as industrial hot spots. It is not possible to estimate the exact development of the waste water discharges due to lacking data, but it can be assessed that discharges have been reduced mainly due to decreased production.

Ongoing or finished activities 1991-98: The data on investment activities is missing.

# 4

## Development at the hot spots by catchment area

### 4.1 Bothnian Bay

#### 4.1.1 Hot spots

Originally two industrial hot spots were taken on the list from the Bothnian Bay area, one was a heavy metal smelter and the other a pulp and paper mill. The pulp and paper mill was deleted from the hot spot list, after it had achieved a substantial reduction in discharges by implementing the required measures.

#### 4.1.2 Discharges to the Bothnian Bay

Discharges have been reduced considerably mainly due to the improved process and pollution control measures implemented at the plants.

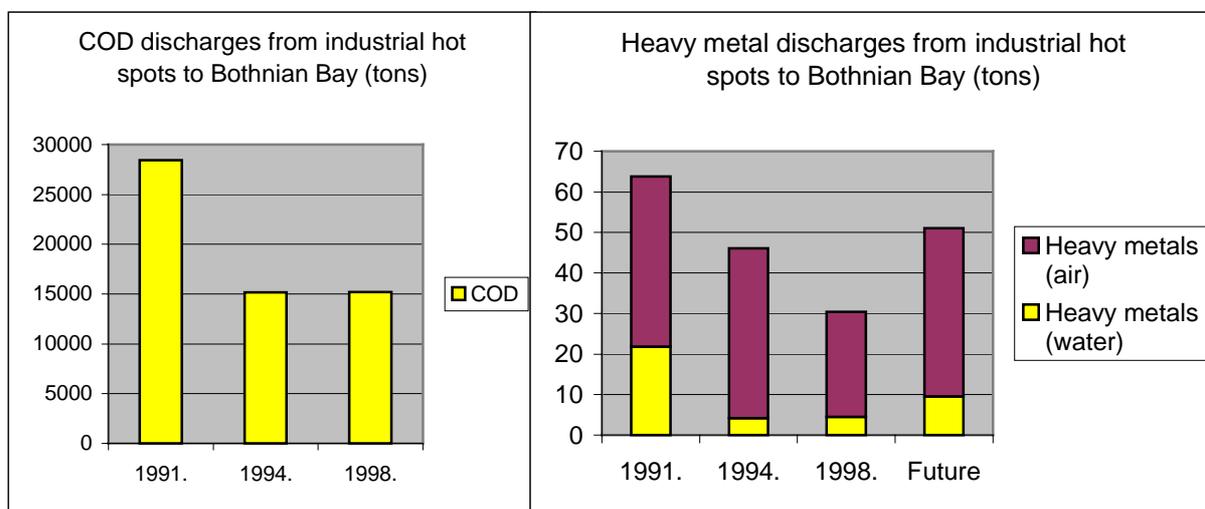


Figure 4.1. Waste water discharges of COD and waste water discharges and air emissions of heavy metals from industrial hot spots to the Bothnian Bay (1 current & 1 deleted hot spot).

#### 4.1.3 Investments in the area

The deleted hot spot (pulp and paper mill) invested in the reduction of waste water discharges (the cost estimate was 18 MEUR) and the estimated needed sum of 45 MEUR has been allocated to reduce emissions from the metal smelter.

#### 4.1.4 Status of hot spots

##### Hot Spot No. 1 Country: Sweden; Name: Rönnskärsverket metal smelter

**Aim:** Reduction of heavy metal discharges and emissions

**Description:** Rönnskärsverket is a Swedish metal smelter which produces copper about 140 000 tons/year. The plant was selected as a hot spot due to high waste water discharges and air emissions of heavy metals. The cost estimate for the proposed remedial actions was 45 MEUR. The plans to enlarge the production have been questioned as it would increase the total pollution loads.

**Development:** The company has allocated 45 MEUR to decrease emissions. Technical assistance and investments are ongoing. The development of the heavy metal emissions has been favourable. Between 1991 and 1997 lead emissions to air and waters decreased from 14,8 tons to 7,8 tons (45%) and cadmium emissions decreased from 0,28 tons to 0,23 tons (18 %). The production of copper is planned to be increased by 115 % to 300 000 tons and therefore the total emissions are expected to rise. Copper production is planned to be increased by 76 % and emissions of metals are expected to increase by about 60 %, which means that the emissions per produced ton of copper will decrease to some extent. The project budget is not available. After completing the ongoing project the plant is expected to be in compliance with relevant HELCOM recommendations.

##### Hot Spot No. 2 Country: Finland; Name: Metsäbotnia OY Kemi, pulp and paper mill

**Aim:** (Reduction of organic substances and nutrients) Deleted hot spot -94

**Description:** Metsäbotnia is a pulp and paper plant that produced 514 000 tons of pulp in 1998. It was originally selected as a hot spot due to its high discharges of organic substances and nutrients. In 1991 its waste water discharges consisted of 6110 tons of BOD<sub>5</sub>, 28 000 tons of COD, 105 tons of N, 22 tons on P<sub>tot</sub>, 317 tons of AOX, 933 tons of SO<sub>x</sub> and 1126 tons of NO<sub>x</sub>. The measures proposed to reach compliance with the JCP criteria were the construction of an activated sludge plant with a cost estimate of 18 MEUR.

**Development:** The plant was removed from the hot spot list in 1994 when it had reduced its COD discharges more than 60 %, BOD<sub>7</sub> discharges more than 90 % and P<sub>tot</sub> discharges more than 50%. Also air emissions were substantially reduced; SO<sub>x</sub> by 65 % and NO<sub>x</sub> by 16 %.

## 4.2 Bothnian Sea

### 4.2.1 Hot spots

Originally five industrial hot spots were taken on the list from the Bothnian Sea area. By 1998 four of them were deleted from the hot spot list, after they had achieved substantial reduction in discharges.

## 4.2.2 Discharges to the Bothnian Sea

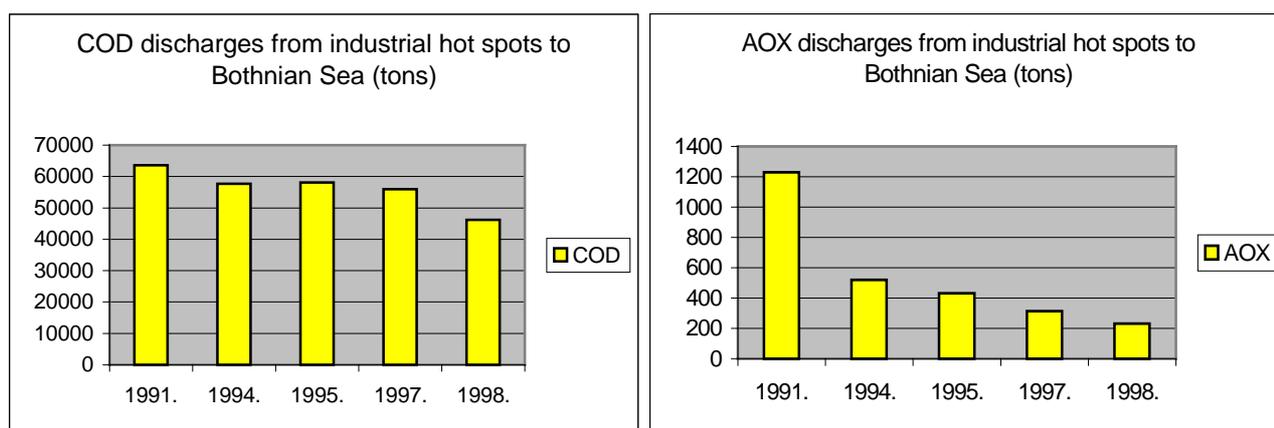


Figure 4.2. Waste water discharges of AOX and COD from industrial hot spots (tons) to the Bothnian Sea. (1 current & 4 deleted hot spots).

The discharges of AOX and COD were considerably reduced in the 90's, due to the implemented process and pollution control measures in the pulp and paper industry. A reduction of other pollutants in the waste waters has also been achieved. BOD<sub>5</sub> discharges have reduced by 7 %, P<sub>tot</sub> discharges by 22 % and heavy metal discharges by 91%, but the discharges of N<sub>tot</sub> have increased by 8 % to 306 tons. The emissions of SO<sub>x</sub> into the air have reduced by 28 % and heavy metal emissions by 82 %. The production has increased considerably from the beginning of the 1990's.

### 4.2.3 Investments in the area

Investments of almost 38 MEUR have been reported in the area, and all the plants except Outokumpu Harjavalta Metals have been deleted from the list.

### 4.2.4 Status of hot spots

#### Hot Spot No. 3 Country: Sweden; Name: Husum Kraft mill, pulp and paper

**Aim:** (Reduction of chlorinated substances) Deleted hot spot -94

**Description:** Husum pulp and paper plant produced 620 000 tons of pulp in 1998. It was originally selected as a hot spot mainly due to its high emissions of chlorinated substances (AOX). In 1991 the discharges of AOX were 530 tons, COD 32 000 tons, BOD<sub>5</sub> 8 522 tons and P<sub>tot</sub> 42 tons. In 1991 the mill was the major polluter among industrial hot spots. It was the third biggest discharger of BOD<sub>5</sub> and fifth biggest discharger of COD of all industrial hot spots. The plant was to reduce the waste water discharges by changing over to a chlorine free bleaching process. The cost estimate for the plant to meet HELCOM JCP criteria was 12 MEUR.

**Development:** The plant was removed from the hot spot list in 1994 after a reduction of AOX discharges by over 50 % from 1991 (64 % by 1998). Between 1991-1998 also other discharges were reduced, COD by 46 %, BOD<sub>5</sub> by 30 %, and P<sub>tot</sub> by 60%. Despite of the favourable development the mill is still the major discharger of BOD<sub>5</sub> and COD among industrial hot spots. The plant is the biggest discharger of

BOD<sub>5</sub> and second biggest discharger of COD among industrial hot spots. The plant's emissions of SO<sub>x</sub> and NO<sub>x</sub> into the air increased by 32% and 46 % during the same time period due to increased production.

**Hot Spot No. 4 Country: Sweden; Name: Östrand, pulp and paper mill**

**Aim:** (Reduction of chlorinated substances) Deleted hot spot -94

**Description:** Östrand is a pulp and paper plant, which produced 362 000 tons of pulp in 1998. It was originally selected as a hot spot because of its high discharges of chlorinated substances (AOX). In 1991 the plant discharged 550 tons of AOX and 21 700 tons of COD. The mill was to reduce waste water discharges by change of bleaching process to chlorine free bleaching.

**Development:** The plant was removed from the hot spots list in 1994. The plant had reduced its AOX-discharges by 98% and COD-discharges by 27 % by 1998.

**Hot Spot No. 5 Country: Sweden; Name: Vallvik, pulp and paper**

**Aim:** (Reduction of chlorinated substances) Deleted hot spot

**Description:** Vallvik is a pulp and paper mill that produced 134 000 tons of pulp in 1998. It was originally selected as a hot spot because of its high discharges of chlorinated substances (AOX). In 1991 the plant discharged 150 tons of AOX and 9 900 tons of COD. The mill was recommended to reduce waste water discharges by change of bleaching process to chlorine free bleaching.

**Development:** The plant was removed from the hot spot list in 1994 when it had reduced its AOX-discharges by over 50 % (by 1998 90%). By 1998 also COD-discharges were reduced by 27 %.

**Hot Spot No. 7 Country: Finland; Name: Outokumpu Harjavalta metals**

**Aim:** Reduction of metals

**Description:** Outokumpu Harjavalta is a metal smelter which produced 167 000 tons of copper anodes and 49 000 tons of nickel in 1998. The plant is quite old in origin, built in 1945, and has developed its own method to smelt the copper (Tamiranta 2000). The plant was selected as a hot spot because of its high discharges and emissions of heavy metals. Especially air-emissions of cadmium and As was estimated to be a serious problem (HELCOM 1993a). The total waste water discharges of heavy metals were 9,15 tons and the emissions to the air were 254 tons in 1991. The plant also released 5 244 tons of SO<sub>x</sub> to the air in 1991. The measures proposed in order to reduce discharges were to improve the processes and the waste water treatment systems. The cost estimate for the plant to meet HELCOM JCP criteria was 12,7 MEUR.

**Development:** There has been a favourable development of the waste water discharges and especially of the air emissions. The waste water discharges of heavy metals decreased to 8,4 tons (8 %), and air emissions of heavy metals dropped significantly to 44 tons (83 %) by 1998. The waste water discharges now comply with most of the requirements in the HELCOM recommendation relevant for the sector. There are however still some problems with fulfilling the requirements for copper and nickel concentrations in effluents. The emissions of SO<sub>x</sub> into the air were reduced by 42 % to 3040 tons between 1991-1998. A part of this favourable development is due to the recovery of sulfuric acid (H<sub>2</sub>SO<sub>4</sub>), which was earlier released to the air as SO<sub>x</sub>. The plant produced 614 000 tons of H<sub>2</sub>SO<sub>4</sub> in 1998, which was utilised by other industries. There are ongoing investments to increase the waste water treatment capacity, to build a new electrostatic precipitator for the copper smelter and to improve the bag filters. The major air pollution control me-

asures have been completed. The waste water discharges of metals are expected to increase in the future as there are plans to increase production, but air emissions of metals are still expected to drop to 34,5 tonnes. The emissions of SO<sub>x</sub> are estimated to increase by 25 %. An amount of 4,4 MEUR has been allocated for environmental investments from the company's own resources.

### **Hot Spot No. 8 Country: Finland; Name: Kemira Oy Vuorikemia (Kemira Pigments Oy) chemical plant**

**Aim:** (Reduction of metals) Deleted hot spot -98

**Description:** Kemira Pigments is a chemical plant which produces titanium dioxide pigment and ferrous sulphate. It was originally selected as a hot spot due to its high discharges of metals (iron and heavy metals) and H<sub>2</sub>SO<sub>4</sub>. In 1991 the waste water discharges of the plant contained 8 500 tons of iron and 87 tons of heavy metals (lead, zinc, chromium). The proposed measure for the reduction of discharges was the neutralisation of the waste waters by construction of a new waste water treatment plant.

**Development:** The plant was deleted from the hot spots list in 1998, when the metal discharges of the plant were reduced substantially after the construction of a new waste water treatment plant. Between the years 1991-1998 the waste water discharges of iron were reduced by almost 100% from 8 500 tons to 3 tons, discharges of lead were reduced from 1 ton to 0,02 tons (98 %), the discharges of zinc were reduced to 0,01 tons (99,99 %) and the discharges of chromium by 99,9 %. The company had invested 21 MEUR by 1996 to reduce waste water discharges.

## **4.3 Gulf Of Finland/Neva River Basin/Lake Ladoga**

### **4.3.1 Hot spots**

In the catchment area of the Gulf of Finland (includes the Neva River Basin and the Lake Ladoga district) there were 10 major industrial plants that were classified as industrial hot spots in 1991. Seven of them were pulp and paper mills (4 Finnish, 1 Russian and two Estonian), one was an aluminium plant, one the metal plating industries in the St. Petersburg area and one the power plants in Narva. There were also four combined hot spots (industrial and municipal) that are covered by the combined industrial and municipal element with Sweden as lead country. Five of the industrial hot spots were deleted by the year 1998. One hot spot was deleted because the plant was closed down and four because of the reduction in discharges due to implemented pollution control measures.

### **4.3.2 Discharges to the Gulf on Finland**

A substantial reduction of discharges from the industrial hot spots was achieved between 1991-1998. However, most of the reduction in discharges and emissions was achieved due to the reduced production.

Finnish pulp and paper mills reduced their emissions considerably by implementing process technology measures and by the construction of treatment plants. The discharges of N<sub>tot</sub> were reduced by 47 %, P<sub>tot</sub> by 65 % and COD by 57 % between 1991-1998. The emissions of NO<sub>x</sub> to the air were reduced by 29 %.

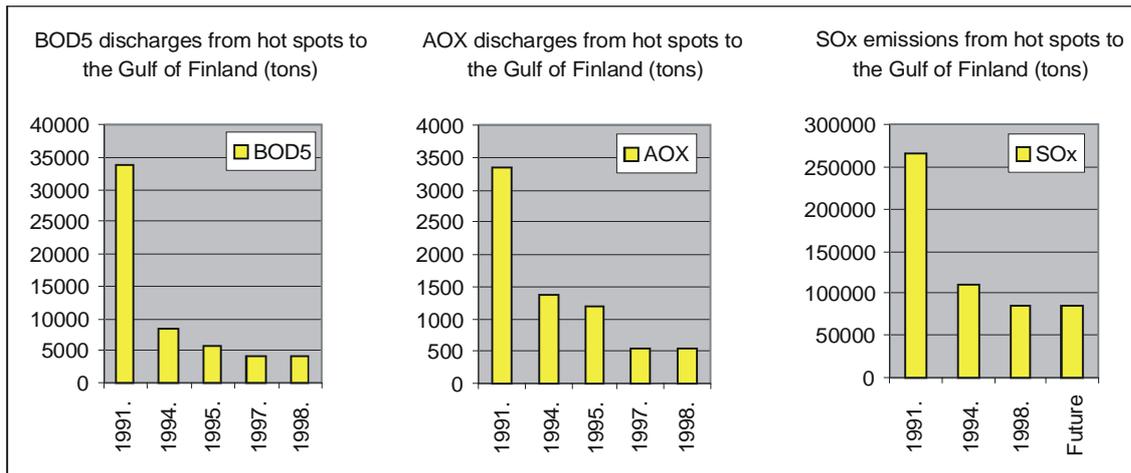


Figure 4.3. Waste water discharges of BOD<sub>5</sub> and AOX, and emissions to the air of SO<sub>x</sub> from industrial hot spots (in tons) to the Gulf of Finland. (5 current & 5 deleted hot spots).

### 4.3.3 Investments in the area

Four Finnish hot spots have implemented the required measures and they were deleted from the hot spot list. The cost estimate was in total 135,4 MEUR. For the other five hot spots in Estonia and Russia investments of 3,03 MEUR have been reported, while the needed investments were originally estimated to be 429 MEUR. Investments have not been allocated sufficiently, especially for the major hot spots (No:s 22 and 25).

### 4.3.4 Status of hot spots

#### Hot Spot No. 11 Country: Finland; Name: YPT Joutseno pulp and paper mill

**Aim:** (Reduction of organic discharges) Deleted hot spot -94

**Description:** YPT Joutseno is a pulp and paper mill which produced 309 000 tons of pulp in 1998. The mill was a hot spot because of the high discharges of organic substances. In 1991 the mill discharged 19 700 tons of COD, 673 tons of AOX, 1 464 tons of BOD<sub>5</sub> and 15 tons of P. The proposed measures were to enlarge the activated sludge plant and to apply oxygen delignification in the process. The cost estimate for the plant to meet HELCOM JCP criteria was 45 MEUR.

**Development:** YPT Joutseno was deleted from the hot spot list in 1994 after a significant reduction in discharges. The discharges of BOD<sub>5</sub> were reduced to 270 tons (82%), COD to 12 281 tons (38 %), AOX to 68 tons (90%) and P<sub>tot</sub> to 11,3 tons (25%) by 1998.

#### Hot Spot No. 12 Country: Finland; Name: Kaukas Lappeenranta pulp and paper mill

**Aim:** (Reduction of organic discharges and nutrients) Deleted hot spot -94

**Description:** Kaukas Lappeenranta is a pulp and paper mill which produced 617 000 tons of pulp in 1998. It was a hot spot because of high discharges of organic substances and nutrients. The mill discharged 4 538 tons of BOD<sub>5</sub>, 36 200 tons of

COD, 674 tons of AOX, 41 tons of  $P_{\text{tot}}$  and 460 tons of  $N_{\text{tot}}$  in 1991. The construction of an activated sludge plant was proposed in order to reduce emissions. The cost estimate was 28 MEUR.

**Development:** Kaukas Lappeenranta was deleted from the hot spot list in 1994 after a substantial reduction in discharges. The discharges of  $BOD_5$  were reduced by 74 %, COD by 44 %, AOX by 84%,  $P_{\text{tot}}$  by 78% and  $N_{\text{tot}}$  by 50 % by 1998, compared with year 1991.

**Hot Spot No. 13 Country: Finland; Name: Enso-Gutzeit Kaukopää (Imatra) pulp and paper mill**

**Aim:** (Reduction of organic discharges and nutrients) Deleted hot spot -94

**Description:** E-G Kaukopää is a pulp and paper mill, which produced 728 000 tons of pulp in 1998. The mill was a hot spot because of high discharges of organic substances and nutrients. In 1991 the mill discharged 13 566 tons of  $BOD_5$ , and was the second biggest discharger of  $BOD_5$  among all industrial hot spots in the Baltic Sea area (only Sovetsk pulp and paper mill discharged more  $BOD_5$ ). The mill also discharged 56 700 tons of COD and 787 tons of AOX and the mill was the biggest industrial discharger of these substances. The  $P_{\text{tot}}$  load was 52 tons in 1991. The construction of an activated sludge plant with a chemical stage for waste water treatment was proposed in order to reduce discharges. The cost estimate for the plant to meet HELCOM JCP criteria was 46 MEUR.

**Development:** E-G Kaukopää was deleted from the hot spots list in 1994 after it had achieved a substantial reduction of discharges. By 1994 the  $BOD_5$  discharges were reduced by more than 90 % (83 % in 1998), AOX discharges by more than 60 % (53%), COD discharges by 68 % (78%) and  $P_{\text{tot}}$  discharges by 77% (50%) compared to the year 1991. The mill is no longer a the most considerable discharger of  $BOD_5$  among the industrial hot spots, but the mill is the biggest discharger of COD an the second biggest discharger of AOX due to the high production volume.

**Hot Spot No. 14 Country: Russia; Name: Syasstroj pulp and paper mill**

**Aim:** Reduction of waste water discharges and atmospheric emissions

**Description:** Syasstroj pulp and paper mill is located by Lake Ladoga. The mill produced 9 tons of pulp in 1998 and was selected as a hot spot because of high emissions and discharges. The mill discharged 1 100 tons of  $BOD_5$ , 37 742 tons of COD, 270 tons of  $N_{\text{tot}}$ , 90 tons of  $P_{\text{tot}}$  and 500 tons of AOX in 1991. The mill also released 5 500 tons of  $SO_x$  into the air. The discharges and emissions were to be reduced mainly by improved process technology and by intensified waste water treatment (HELCOM 1993b). The waste water discharges were to decrease by 35 % and the emissions of  $SO_x$  by 55% compared to the situation in 1991 after the implementation of the proposed measures. The total cost estimate was about 30 MEUR.

**Development:** The discharges of  $BOD_5$  and phosphorus decreased more than 50 % and the discharges of  $N_{\text{tot}}$  about 30 % between 1991-1998. The emissions of  $SO_x$  have stayed at about the same level during the 1990's. It is difficult to evaluate the reason for the development due to the lack of data, but in 1997 the mill operated for only 3 months. The pollution load has been far from compliance with HELCOM recommendations for pulp production. There is an environmental project ongoing for water pollution control and waste management. The construction work has started, and the project was estimated to be completed in 1998. Investments are funded from local sources. A disastrous accident occurred in the plant in December 1998, when the waste water dam collapsed and 400 000 m<sup>3</sup> of polluted water floo-

ded, which caused an interruption in the drinking water supply of the city. The plant developed a plan concerning the prevention of silt discharge into the river during the flooding and the warm period of year.

**Hot Spot No. 15 Country: Russia; Name: Volkhov aluminium factory**

**Aim:** Reduction of waste water and atmospheric emissions

**Description:** The Volkhov aluminium factory is located by Lake Lagoda, near St. Petersburg. The plant was built in 1932. The capacity of the plant is 22 000 tons of aluminium, and the production was 11 500 tons of aluminium in 1998. The plant was selected as a hot spot due to high emissions and discharges, and also due to the fact that a large hill of phosphorous gypsum was located close to the plant (www.russiajournal.com). In 1991 the mill discharged 280 tons of P<sub>tot</sub> and 29 tons of aluminium in 1995. The environmental problems were to be reduced by improved process technology, by installing electrostatic precipitators and by the construction of a waste water treatment plant. The implementation of the proposed measures were to decrease the emissions of SO<sub>x</sub> by 60% and the organic substances in waste waters by about 40 % from the situation in 1991 (HELCOM 1993b). The total cost estimate of the project was 2,8 MEUR.

**Development:** The waste water load from the plant has decreased significantly, BOD<sub>5</sub> and N- discharges by more than 80 % and P-discharges by more than 70%. On the other hand the emissions of SO<sub>x</sub> have increased by more than 30% in the 90's. In 1995 the cement and aluminium production was stopped and superphosphate production was restructured. There has been technical assistance and investments ongoing in the plant. An environmental assessment has been conducted and a technical design project has been made for 1) the reconstruction of super phosphate and sulphate units, 2) the reconstruction of furnaces and 3) on the reconstruction of the cement plant (HELCOM PITF 10/97). After the completion of the projects the production is expected to rise. Investments of 1,6 MEUR have already been allocated according to reports.

**Hot Spot No. 16 Country: Finland; Name: Sunila Oy Kotka pulp and paper mill**

**Aim:** (Reduction of discharges of organic substances) Deleted hot spot -94

**Description:** Sunila Oy Kotka is a pulp and paper mill which produced 137 000 tons of pulp in 1998. The mill was originally a hot spot because of considerable waste water discharges of organic substances. The mill discharged 4 540 tons of BOD<sub>5</sub>, 22 800 tons of COD and 710 tons of AOX in 1991. The construction of an activated sludge plant and the separation of cooling waters from effluents were proposed in order to reduce discharges. The cost estimate for the plant to meet HELCOM JCP criteria was 16,4 MEUR.

**Development:** The plant was removed from the hot spot list in 1994 after a substantial reduction in discharges. The plant had reduced the BOD<sub>5</sub> discharges by 95 %, COD discharges by 71 % and AOX discharges by 93% by the year 1998. This was achieved by the construction of an activated sludge plant and the separation of clean cooling waters from process waste waters, the modernisation of the steam boiler, changes in the fluidised bed combustion, installation of an electric precipitator and a sludge drier. The investments of 15,2 MEUR were from the company's own funds.

**Hot Spot No. 22 Country: Russia; Name: St Petersburg area's metal plating plants (300 units)**

**Aim:** Reduction of heavy metal discharges in waste waters

**Description:** The metal plating industry in the area consists of about 300 metal plating plants. The plants produced in total about 5 million m<sup>2</sup> of metal surface in 1991. Only about 90 of the plants had some kind of pre-treatment for waste waters in 1991 and the industrial area was selected as a hot spot due to high discharges of metals. They hampered the functioning of the municipal waste water treatment plants and worsened the quality of the sludge in such a way that it could not be used in agriculture. The discharges of other toxic substances also played a significant role. In 1990 these plants were responsible for about 22 % of the cadmium discharges and 15 % of the lead discharges in the St Petersburg region (Environmental ... 1991a). It was proposed that internal process modifications would be implemented to reduce the water consumption. The improvement of plating and pretreatment processes to reduce waste water discharges were also considered necessary. The total cost estimate was about 203 MEUR.

**Development:** Between the years 1991-1995 the total amount of metals in waste water was reduced only slightly, but the amount of some harmful heavy metals like lead and cadmium was reduced considerably. The discharges of lead were reduced from 6 tons to 0,5 tons (92%) and the discharges of cadmium were reduced from 50 kg to 10 kg (80%). No exact data of the waste water discharges has been received after 1995. The total amount of metals in the waste water discharges has generally decreased in the St Petersburg area from 99.9% for mercury to 26 % for lead between 1995-1998. The exceptions are tin and manganese for which the discharges have increased by 250 % and 10 % respectively. There is technical assistance and investments ongoing in several of the metal plating plants in the area. Assistance is coming from Danish, German, and local sources. The projects include the assessment of pollution loads, a federal programme for the reconstruction of several galvanising plants between 1995-2001 and a project on waste management for galvanic and aluminium wastes (HELCOM PITF 10/97).

**Hot Spot No. 25 Name: Narva oil shale power plant PRIORITY HOT SPOT**

**Aim:** Reduction of emissions of sulphur and dust

**Description:** The Narva oil shale power plants are major producers of electricity in Estonia. There are two separate large electrical plants in the Narva area. In 1990 the plants used 21,5 Mt (10.5 + 11 Mt) of oil shale, and the production of electricity was 7.43 + 8.75 TWh. The plants in Narva were selected as priority hot spots due to their high SO<sub>x</sub> and dust emissions. The emissions from the plants were 75 % of the total SO<sub>x</sub>-emissions in Estonia and about half of the reported SO<sub>x</sub>-emissions of all industrial hot spots. In 1990 the plants released 252 000 tons of SO<sub>x</sub>, 14 570 tons of NO<sub>x</sub> and 178 600 tons of dust into the air. The high amount of emissions were partly due to the composition of the fuel (sulphur content 1,55 %, nitrogen content 0,1 %, ash content 43,6 % and water content 12 %), and due to the fact that the plant also had old and inefficient boilers. The fuel comes mainly from Estonia (75%) (Environmental ... 1991b).

The transboundary environmental impacts of the plants are extensive. The emissions have been assessed to have a significant effect on the sulphur depositions in the St Petersburg region, southern Karelia and Southern Finland. The deposits are estimated to be about 25 % higher because of Narva. The local impacts of

the plants are mainly caused by dust including also health problems. The dust emissions have on the other hand a positive effect on the environment by neutralising the effects of acidic deposition (HELCOM 1993b).

It was estimated that the plants could reduce their SO<sub>x</sub> emissions by 70-90 % after replacing the old boilers and the construction of new desulphurisation plants (Environmental... 1991b). The estimated cost for the project was originally 1071 MEUR in 1990, but the cost estimate dropped to 225 MEUR in 1994.

**Development:** The reduction of emissions of SO<sub>x</sub> and dust has been significant, about 70 % between 1990-1994. By 1994 no major changes to the processes of the power plants were made, but the burning of oil shale was reduced by 43 % to 13 Mtons from 23 Mtons, which mainly explains the reduction of emissions. Investments of 3 MEUR were incurred by 1994 (BSEP 1994a). There is technical assistance ongoing at the moment and a refurbishment study is completed. Investments have been planned for the time period 1997-2000 according to data from 1995. The power plants have installed several electrostatic precipitators on the boilers. A replacement of the existing boilers with modern boilers to reduce the emissions of SO<sub>x</sub> has been planned. The plant is also planned to be privatised. The environmental programmes are planned with assistance of foreign consultants and are supported by at least Finland and NIB.

### Hot Spot No. 27 Country: Estonia Name: Horizon ltd, Kehra pulp and paper mill

**Aim:** Reduction of atmospheric emissions

**Description:** The Kehra pulp and paper mill was selected as a hot spot due to high atmospheric emissions. The plant is located on the coast of the Gulf of Finland close to the Tallinn pulp and paper mill. The plant produced 40 000 tons of unbleached kraft pulp and paper products and sacks in 1990. The mill is quite old and the latest modifications to the processes were made during 1975-1980. The plant had a biological treatment plant built in 1977 with a treatment capacity of 30 500 m<sup>3</sup>/day, and was in full use. The enlargement of the plant started in 1989.

In 1991 the plant released 2 500 tons of SO<sub>x</sub> into the air and discharged 610 tons of BOD<sub>5</sub>, 50 tons of N<sub>tot</sub> and 730 tons of suspended solids into the waters. The environmental problems of the mill were proposed to be reduced mainly by technological measures and by installing an electrostatic precipitator. The implementation of the proposed measures was estimated to reduce sulphur dioxide emissions by 65-70%. The total cost estimate of the project was 5,9 MEUR. The cost estimate was later reduced to 0,67 MEUR (Environmental ... 1991c).

**Development:** The plant was closed between 1992-1994 and reopened in 1995. The emissions of SO<sub>x</sub> were reduced by more than 2/3 between 1991-1998 for the years when it was operating. The emissions are still expected to drop by 25 % the environmental project is completed. The development in NO<sub>x</sub>-emissions has not been as favourable and emissions have been reported to increase by 400% (59 tons in 1998), but there is no explanation to the huge increase. The emissions are however expected to drop considerably after the implementation of the environmental project. The waste water discharges of BOD<sub>5</sub> were reduced by 86 %, P<sub>tot</sub> by 27 % and N<sub>tot</sub> by 44 % between 1991-1998. A considerable reduction in discharges would still be needed to fulfil the requirements of relevant HELCOM recommendations for pulp production (eg. a reduction of 60 % in P<sub>tot</sub> discharges would be required (figures of 1998)). The ongoing environmental project includes 1) water pollution control: the reconstruction of an aeration system (completed) 2) air pollution control: the replacing of the collecting and discharge electrodes of the electrostatic precipi-

tator (completed) and 3) waste management: the construction of a boiler. Investments of 0,3 MEUR has been allocated so far. The project is supported by Swedish donors.

**Hot Spot No. 29 Country: Estonia; Name: Tallinn pulp and paper mill**

**Aim:** (Reduction of waste water discharges) Deleted hot spot -94

**Description:** The Tallinn pulp and paper mill was a hot spot because of high waste water discharges. It was located on the coast of Gulf of Finland close to Kehra pulp and paper mill. The mill produced sulphite pulp 20 000 tons/year (capacity 60 000 tons) in 1991. The mill was quite old and it was suggested to close it down because of environmental reasons, there was e.g. no recovery system for the cooking chemicals. In 1991 the mill discharged 450 tons of N<sub>tot</sub> and 8 000 tons of BOD<sub>5</sub>. If production would have continued it was proposed to reduce discharges by construction of a new evaporation plant and by improving the waste water filtration plant. It was expected that the environmental project would reduce the organic substances of the waste waters by about 75 % and suspended solids by about 85 %. The cost estimate for this was about 2,9 MEUR (Environmental... 1991c).

**Development:** The mill was deleted from the hot spots list in 1994 after the production stopped.

## **4.4 Gulf Of Riga/Daugava River Basin**

### **4.4.1 Hot spots**

Six industrial hot spots were selected from the catchment area. One of these hot spots, a food processing industry, is located in Estonia. The others are Latvian, one pulp and paper mill, one pharmaceutical plant, two metal industries and one hot spot with various industries. In addition five hot spots were combined and are handled under the combined municipal and industrial element.

### **4.4.2 Discharges to Gulf of Riga/Daugava River Basin**

The discharges from industrial hot spots to the Gulf of Riga have been reduced significantly, mainly due to considerably reduced production of the plants (the waste water flow of hot spots was reduced by 90 %) (See Figure 4.4).

### **4.4.3 Investments in the area**

No cost estimate for reducing the discharges from industrial hot spots in the area was made. No investments were reported due to expected privatisation of the plants and closing of the Vohma meat combine.

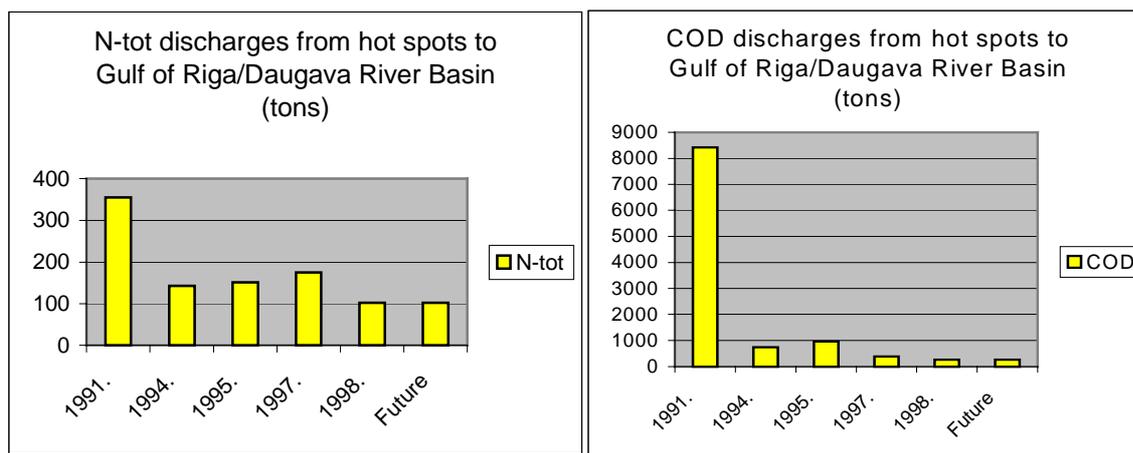


Figure 4.4. Waste water discharges of COD and  $N_{tot}$  to the Gulf of Riga/Daugava River Basin (tons). (5 remaining & 1 deleted hot spot).

#### 4.4.4 Status of hot spots

##### Hot Spot No. 35 Country: Estonia; Name: Vohma meat combine

**Aim:** Reduction of organic substances and nutrients

**Description:** Vohma meat combine was selected as a hot spot due to high discharges of organic substances. The meat combine was the main industrial enterprise in the area. The plant had its own waste water treatment plant that was constructed in 1975. The plant was old fashioned, the machinery was out of date and the quality of the construction work was poor. The discharges of organic substances were more than twice the planned level, hindering effective treatment. The sludge management was problematic, for example drainage beds were not big enough. The sludge problem caused trouble with local authorities. As a measure to reduce discharges improvement of the waste water treatment plant was proposed.

**Development:** The plant was removed from the hot spot list in 1997 after being closed down.

##### Hot spot No. 38 Country: Latvia; Name: Sloka pulp and paper mill PRIORITY HOT SPOT

**Aim:** Reduction of the pollution load to the Lielupe river

**Description:** Sloka is a pulp and paper mill which was selected as a priority hot spot due to its high waste water discharges. In 1991 it discharged 6 600 tons of COD, 120 tons of  $N_{tot}$  and 12 tons of  $P_{tot}$ . The updating of technology and of the local waste water treatment plant was proposed in order to reduce waste water discharges. The cost estimate for the modernisation of the plant was 72 MEUR.

**Development:** There is a privatisation programme (BEAROP, phase II) ongoing at the plant (1999-2001) and the buildings are being dismantled. The production of pulp and paper has ceased in 1995. No investments were made before 1998.

**Hot spot No. 39 Country: Latvia; Name: Olaine Latvbiofarm pharmaceutical plant PRIORITY HOT SPOT**

**Aim:** Reduction of surface water, groundwater and air pollution

**Description:** The plant located in Olaine, about 20 km from Riga was one of the former Soviet Union's major pharmaceutical companies. The plant produces a wide variety of pharmaceuticals. Latvbiofarm is the largest industry in an area with several industries. Olaine is also an agricultural area which supplies Riga with much of vegetables and other products. Latvbiofarm supplies the town of Olaine with heating. The economic condition of the plant was very unstable in the beginning of the 90's (BSEP 1994d).

The environmental problems of the plant include impacts on water, air and soil. The waste water from all the plants in the area are treated in the waste water treatment plant owned and operated by Latvbiofarm. The waste water is treated biologically, but the capacity was enough to treat only 25 % of the waste water in 1990. The plant discharged 220 tons on  $N_{tot}$ , 1 800 tons of COD and 130 tons of  $BOD_5$  to water in 1991. The load of N and  $BOD_5$  was estimated to be more than two times compared to the requirements laid down in the HELCOM recommendations for food industry. The plant also releases acidic and other substances into the air. The measures proposed to reduce discharges were the introduction of cleaner technologies, recycling, partial separation of the waste water treatment and waste incineration. The cost estimate to fulfil the HELCOM JCP criteria was approximately 19 MEUR (BSEP 1994d).

**Development:** The production has dropped to 30 % of the capacity and the number of employees has been reduced from 5 500 to 900 between 1992-1994. There is a privatisation programme ongoing (BEARPP II phase). The waste water discharges of the plant have decreased,  $BOD_5$  discharges decreased by 88 %, COD discharges by 91 % and N discharges by 87 %. The reduction of discharges seems to be due to the decreased production, since no data of the allocated investments have been reported.

**Hot spot No. 43 Country: Latvia; Name: VEF metal plant**

**Aim:** Reduction of pollution from galvanisation plants

**Description:** The plant in Riga manufactures radio and telephone equipment. The plant was selected as a hot spot because of high discharges of metals. It discharged a total of 2,8 tons of metals, mainly iron and copper, to water in 1991. The plant also released about 2 070 tons of  $NO_x$  into the air. The measure proposed to reduce discharges was the updating of technology in the galvanic production. The cost estimate of meeting HELCOM JCP criteria was not made.

**Development:** The metal discharges of the plant were reduced by about 84 %, mainly due to the decrease in production (80% between 1991-1996). There was an environmental project carried out in 1996 supported by Denmark (HELCOM PITF 10/97). A privatisation programme is ongoing, and other projects are not decided due to the expected privatisation of the plant.

**Hot spot No. 44 Country: Latvia; Name: RER metal plant**

**Aim:** Reduction of pollution from galvanisation plants

**Description:** The RER plant produces electronic equipment and is located in Riga. The plant was selected as a hot spot because of high discharges of metals. In 1991 the plant discharged a total of 0,11 tons of metals, mainly chromium and iron to water. The measure proposed to reduce discharges was the updating of technology in the galvanic production. The cost estimate for the plant to meet HELCOM JCP criteria was not available.

**Development:** The production volume has varied with time with a general decreasing trend between 1991-1998 and the waste water flow was reduced by 46 %. The waste water discharges of various pollutants were also reduced by 17-45 %. In 1996 an environmental review of the plant was carried out. The plant is undergoing an privatisation process which is estimated to be carried out by 2001.

**Hot spot No. 45 Country: Latvia; Name: Riga (various industries)**

**Aim:** Reduction of pollution load

**Description:** There are several polluting industries in the Riga area. There is no accurate data from the industrial area on the waste water discharges and air emissions. Measures proposed to reduce discharges were the minimisation of solid waste generation and the reduction of pollution in general. The cost estimate for the plant to meet HELCOM JCP criteria was not available.

**Development:** The biggest industrial plants have decreased the production significantly, and it can be estimated that discharges have been reduced accordingly. There are no reported investment activities ongoing in the area.

## **4.5 Eastern Gotland Basin**

This basin includes three sub-regions, Nemunas river basin, Kaliningrad region and Vistula River Basin on the Polish coast. The areas are described in detail in the following chapters.

### **4.5.1 Nemunas River Basin**

#### **4.5.1.1 Hot spots**

Five hot spots were selected as hot spots from the Nemunas river basin area: two pulp and paper mills, one food processing plant, one chemical plant and one fertiliser plant.

#### **4.5.1.2 Discharges to the Nemunas River Basin**

Discharges and emissions in the area have been considerably reduced mainly due to reduced production at the plants and to some extent due to implemented environmental projects in the priority hot spots Neman and Sovetsk pulp and paper mills (See Figure 4.5).

#### **4.5.1.3 Investments in the area**

Investments of 30 MEUR were allocated in the area out of the 107 MEUR estimated need to meet HELCOM JCP criteria.

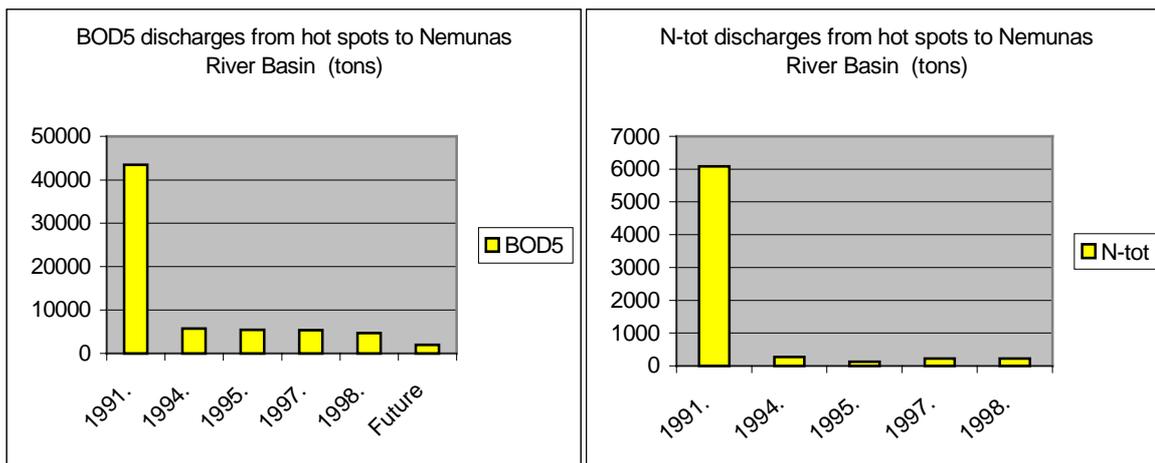


Figure 4.5. Waste water discharges of BOD<sub>5</sub> and N<sub>tot</sub> from the Nemunas River Basin industrial hot spots (tons) (5 hot spots).

#### 4.5.1.4 Status of hot spots

##### Hot Spot No. 49 Country: Russia; Name: Sovetsk pulp and paper mill PRIORITY HOT SPOT

**Aim:** Reduction in input of organic matter and nutrients

**Description:** Sovetsk is a pulp and paper mill in the Kaliningrad region, which produced 17 000 tons of pulp in 1998. The mill is a priority hot spot due to high discharges of organic substances. Sovetsk and three other pulp and paper mills in the region (Hot spots No. 50, 68 and 69) were estimated to cause the major part of the organic load from the point sources in the Kaliningrad region. The plants released 55 000 tons of BOD<sub>5</sub> (60 % of the total load in the area) and 3 220 tons (50 %) of ammonium nitrogen. The problem was focused on the outdated process technology in use and the lack of waste water treatment. In 1991 the Sovetsk pulp and paper mill discharged 35 000 tons of BOD<sub>5</sub>, which was about 35 % of the total load in the region, 3 300 tons on N<sub>tot</sub> and 52 tons of P<sub>tot</sub>. To fulfil the requirements of HELCOM recommendations for pulp industry, a reduction of 330 tons of BOD<sub>5</sub> (99 %), 210 tons of N<sub>tot</sub> discharges (92 %) and 33 tons of P<sub>tot</sub> discharges (37%) would be required. The preliminary study concluded that three out of the four pulp and paper mills in the Kaliningrad region, Sovetsk included, would not be able to survive as pulp producers in the new economy (HELCOM 1993b). The original cost estimate was only 3,3 MEUR, since production was expected to cease.

**Development:** Sovetsk has reduced its waste water discharges considerably between 1991-1998. BOD<sub>5</sub>-discharges were reduced by over 90 %, N<sub>tot</sub> waste water discharges by 95 % and P<sub>tot</sub> discharges by 98 %. This is partly due to reduced production, since waste water flow was reduced by 75 % in the same time period. The reduction of waste water discharges per production unit have been achieved by the construction of a wastewater treatment plant, of which about 60 % was completed in 1994. The funds available in 1994 were only enough to support the operation of those parts already completed. The new treatment plant designed and partly constructed comprises 2 treatment lines, one for waste water from the paper mill and the other for domestic wastewater from the town of Sovetsk. The combined treatment plant has an estimated treatment capacity of 95 thousand m<sup>3</sup>/day (BSEP 1994e). Contrary to the preliminary evaluation, Sovetsk has survived the pressure from the new economy. The new cost estimate for the modernisation project was

64 MEUR. Investments of 26 MEUR have been allocated, but due to the lack of centralised funding the construction has stopped in 1998. Remaining costs are 38,5 MEUR. The original time schedule was for 1983-2000.

**Hot Spot No. 50 Country: Russia; Name: Neman pulp and paper mill  
PRIORITY HOT SPOT**

**Aim:** Reduction in output of organic matter and nutrients

**Description:** (See also hot spot No. 49) The Neman pulp and paper mill is located near the Neman city, and both the mill and the city discharge their waste waters into the Nemunas river. The plant produced 1 000 ton of pulp in 1998. The mill, like the Sovetsk mill, was evaluated to be outdated. Originally there was no effective treatment of waste waters, except for some preliminary treatment of waste waters from the principal paper mill. The mill discharged 5 300 tons of BOD<sub>5</sub> and 2 700 tons of N<sub>tot</sub> in 1991. To fulfil the requirements of HELCOM recommendations for pulp production, BOD<sub>5</sub> discharges would have to be reduced to 90 tons (a reduction of 98 %), N<sub>tot</sub> discharges to 72 tons (97 %) and P<sub>tot</sub> discharges to 9 tons (36%). The plant was assessed not to survive as a pulp producer in the new economy (BSEP 1994e). The cost estimate was originally 4,7 MEUR.

**Development:** In 1994 the production was less than 40 % of the capacity of the mill. By 1994 the only completed measure for wastewater treatment comprised some preliminary works for land reclamation and storage and housing for the main construction works (BSEP 1994d). The mill was practically closed down in 1998. The waste water discharges from the mill decreased accordingly, by over 95 %. An environmental project on the construction of a combined treatment plant for the town and the pulp and paper mill was planned with an estimated capacity of 95 000 m<sup>3</sup>/day. The implementation of the project was stopped in 1998 due to the lack of centralised funding. A new cost estimate for improving the plant was 7,3 MEUR of which 1,1 million has been allocated.

**Hot spot No. 52 Country: Lithuania; Name: Janova Azotas fertiliser plant**

**Aim:** Reduction of pollution load

**Description:** The Janova Azota fertiliser plant in Lithuania was selected as a hot spot due to its high discharges of organic substances. The plant discharged 53 tons of BOD<sub>5</sub>, 50 tons of N<sub>tot</sub> and 0,9 tons of P to the waters in 1991. The plant also released 450 tons of SO<sub>x</sub> to the air. Measures proposed for the reduction of discharges were the construction of 1) a station for trapping contaminated subterranean water 2) a WWTP and 3) the introduction of modern technology. The cost estimate of improving the technology of the plant was 35 MEUR in 1991.

**Development:** The waste water flow has decreased by 81 % between 1991-1998, which indicates reduced production. Also waste water discharges and air emissions have decreased considerably, BOD<sub>5</sub> by 87 %, N<sub>tot</sub> by 41 %, P<sub>tot</sub> by 80 % and SO<sub>x</sub> by 85 %. There is technical assistance ongoing at the plant for water pollution control measures (in 1998), but no investments have been made. The water pollution control programme has been supported by USAID.

**Hot spot No. 54 Country: Lithuania; Name: Kedainiai fertiliser plant**

**Aim:** Reduction of pollution load

**Description:** Kedainiai is a fertiliser plant which was selected as a hot spot because of its waste water discharges. It produces sulphuric acid, phosphoric acid, single superphosphate, monoammonium phosphate and aluminium fluoride. In 1991 the discharges were 38 tons of N<sub>tot</sub> and 47 tons of P<sub>tot</sub>, and emissions to the air

were 1 619 tons of SO<sub>x</sub>. The measure proposed to reduce discharges was the modernisation of the crude oil combustion process. The cost estimate for the improvement of the technology was 6 MEUR in 1991.

**Development:** The waste water flow decreased more than 2/3 between 1991-1998, which indicates reduced production. N<sub>tot</sub> discharges decreased by 45 % and P<sub>tot</sub> discharges by 28% and emissions of SO<sub>x</sub> into the air decreased by 77 %. There is technical assistance ongoing at the plant to improve waste water pollution control measures, but no investments are reported. There has been also a one year waste minimisation project conducted through the World Environment Center (WEC) in 1996, which was funded by USAID. (www.kemworks.com.)

**Hot spot No. 56 Country: Lithuania; Name: Panevezys food processing industry**

**Aim:** Reduction of pollution load

**Description:** Panevezys is a food processing plant which is a hot spot because of the high pollution load. In 1991 the discharges were 3 100 tons of BOD<sub>5</sub> to water and 4 tons of SO<sub>x</sub> to the air. In the preliminary study it was proposed to invest in water utilisation and in improved operation of the waste water treatment equipment. The cost estimate for the improvements was 0,15 MEUR in 1994.

**Development:** It seems that the production at the plant has almost stopped. The waste water flow was reduced by 95 % and emissions of SO<sub>x</sub> by 99% between 1991-1998. There has been an environmental assessment carried out at the plant supported by Denmark. The new cost estimate for the upgrading of technology is 0,17 MEUR, but no investments have been made so far.

## **4.5.2 Lithuanian Coast/Kaliningrad Region**

### **4.5.2.1 Hot spots**

Originally 5 hot spots were selected from the area. Three of them were located in the Kaliningrad region and two on the Lithuanian coast. Three of them were pulp and paper mills, one an oil bunkering station and one an oil refinery and marine terminal. One pulp and paper mill was deleted from the hot spot list in 1998 after its production had stopped.

### **4.5.2.2 Discharges to Lithuanian Coast/Kaliningrad Region**

The waste water discharges have been considerably reduced, mainly due to reduced production as two of the hot spots stopped their production in 1998 of which one permanently. Also the implementation of environmental projects has played some minor role in the achieved reduction of discharges. Waste water discharges of P<sub>tot</sub> were reduced by 80 % in 1991-98 and oil spills were reduced to 2,5 tons between 1991-1995 (35 %). The emissions of SO<sub>x</sub> into the air have in contrary increased 10 % and NO<sub>x</sub> emissions 100 % to 2 900 tons in the area.

### **4.5.2.3 Investments in the area**

The cost estimate for the implementation of the proposed measures for the two (one was deleted) pulp and paper industries was estimated to be 31 MEUR, of which 0,9 MEUR has been invested. The cost estimate for two oil industry hot spots was not available.

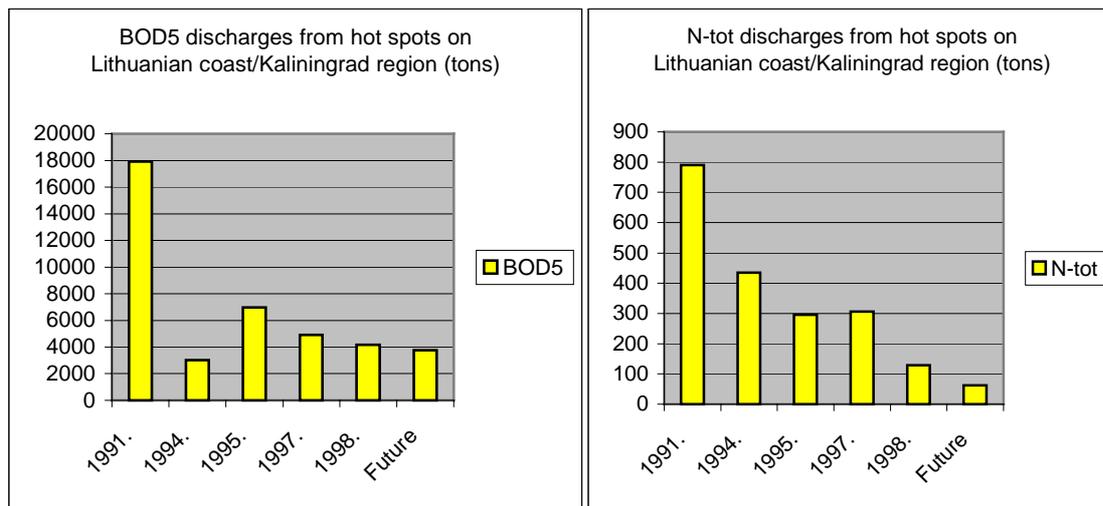


Figure 4.6. Waste water discharges of BOD<sub>5</sub> and N<sub>tot</sub> from Lithuanian coast/Kaliningrad region industrial hot spots (tons) (5 hot spots).

#### 4.5.2.4 Status of hot spots

##### Hot spot No. 62 Country: Lithuania; Name: Mazeikiai oil refinery and marine terminal

**Aim:** Reduction of pollution load

**Description:** The Mazeikiai oil refinery and marine terminal was selected as a hot spot due to high discharges of oil, P<sub>tot</sub> and N<sub>tot</sub>. In 1991 the discharges of N<sub>tot</sub> were 550 tons, P<sub>tot</sub> 57 tons and oil 3,3 tons. The plant also released 3 370 tons of SO<sub>x</sub> into the air. The proposed measures to reduce pollution were the reconstruction of the plant and construction of a waste water treatment plant. The cost estimate to reduce pollution was not available.

**Development:** The waste water flow has decreased 70 % between the years 1991-1998, which is probably due to reduced production. The waste water discharges of the plant have decreased more, N<sub>tot</sub> by 90 % and P<sub>tot</sub> by 96 %, and the discharges of oil by 30 %. The emissions of both SO<sub>x</sub> and NO<sub>x</sub> to the air have on the other hand increased by 173 %. This indicates that there has been a substantial increase in the burning of fuel (electricity/heat for local people/industries). There is no accurate reported data on environmental projects ongoing in the plant.

##### Hot spot No. 64 Country: Lithuania; Name: Klaipeda cardboard factory

**Aim:** Reduction of pollution load

**Description:** Klaipeda is a cardboard factory which was selected as a hot spot due to its high pollution load in general. In 1991 the discharges were 6 100 tons of BOD<sub>5</sub>, 2 500 tons of COD, 240 tons of N<sub>tot</sub> and 4,3 tons of P<sub>tot</sub>, and the emissions to air were 855 tons of SO<sub>x</sub>. The measure proposed to reduce discharges was the modernisation of the waste water treatment plant. The cost estimate for the modernisation of the plant was 30 MEUR.

**Development:** Production at the plant ended in 1994.

**Hot Spot No. 68 Country: Russia; Name: Kaliningrad pulp and paper mill no. 1**

**Aim:** (Reduction in output of organic matter and nutrients) Deleted Hot Spot -98

**Description:** (See also hot spot No. 49) The Kaliningrad pulp and paper mill No. 1 was assessed in the preliminary study to be out of date and not profitable in the new economy (BSEP 1994e). In 1991 the discharges from the mill were 5 700 tons of BOD<sub>5</sub>. The proposed measures to reduce the discharges were the development of the technology and the renovation of the waste water treatment plant. The cost estimate for the plant to meet the HELCOM JCP criteria was 0,6 MEUR.

**Development:** The factory was removed from the hot spot list in 1998 after the production had ended.

**Hot Spot No. 69 Country: Russia; Name: Kaliningrad pulp and paper mill no. 2**

**Aim:** Reduction in output of organic matter and nutrients

**Description:** The second pulp and paper mill in Kaliningrad was evaluated to be the only one to survive in the new economy in the Kaliningrad region (see also hot spot No. 49). In 1991 the mill discharged 6 000 tons of BOD<sub>5</sub> to water and released 3 000 tons of SO<sub>x</sub> into the air. The measure proposed to reduce pollution was to change the pulping process into a magnesium-based sulphite process, provided that there is enough wood available in the area or in neighbouring areas (BSEP 1994e). It was also proposed to renovate the waste water treatment plant. The cost estimate of the environmental projects was almost 0,6 MEUR. The cost estimate was raised to about 1,4 MEUR in 1999.

**Development:** The waste water discharges of BOD<sub>5</sub> were reduced by almost 1/3 between the years 1991-1998. Also the emissions of SO<sub>x</sub> into the air were reduced considerably, more than 70 %. The P<sub>tot</sub> and N<sub>tot</sub> discharges seem to have increased but the development is difficult to assess as the amount of nutrients is reported to have fluctuated up to 5 000 fold compared to the previous year, which cannot be correct. The production process has been changed to chlorine-free production. The reconstruction of the internal sewage system and of the local WWTP is ongoing. The construction of a combined biological WWTP for the municipal waste water of the city of Kaliningrad and the local industries is also ongoing. The project was estimated to be completed in 2000. Investments of 0,9 MEUR have been allocated and 0,5 MEUR remains to be invested.

**Hot Spot No. 71 Country: Russia; Name: Oil bunkering station in Kaliningrad harbour**

**Aim:** reduction of oil discharges in waste water

**Description:** The Kaliningrad oil bunkering station in Kaliningrad harbour was selected as a hot spot due to the oil discharges. The preliminary study concluded, that with limited investments and some technical assistance it would be possible to solve the major pollution problem. This could be done by improvement of the treatment plant for oily water and the updating of the technical equipment of the oil terminal (HELCOM 1993b). The cost estimate for this was unclear.

**Development:** There has not been any technical assistance or investments ongoing in the oil bunkering station due to the lack of funds. The discharges of oil into the Baltic sea were reduced from 0,5 tons to 0,2 tons (60 %) between 1991-1995. In 1998 oil discharges were not reported. The waste water is treated mechanically, but the treatment is insufficient.

### 4.5.3 Vistula River Basin/Baltic Coast Of Poland

#### 4.5.3.1 Hot spots

A total of seven industrial hot spots were selected as hot spots from the area. There are also several other combined industrial and municipal hot spots, but they are dealt with in the Swedish report (Swedish... 1996). Four of these industrial hot spots are chemical plants, one is a metal industry plant, one a pulp and paper mill and one represents mining industry.

#### 4.5.3.2 Discharges to the Vistula River Basin

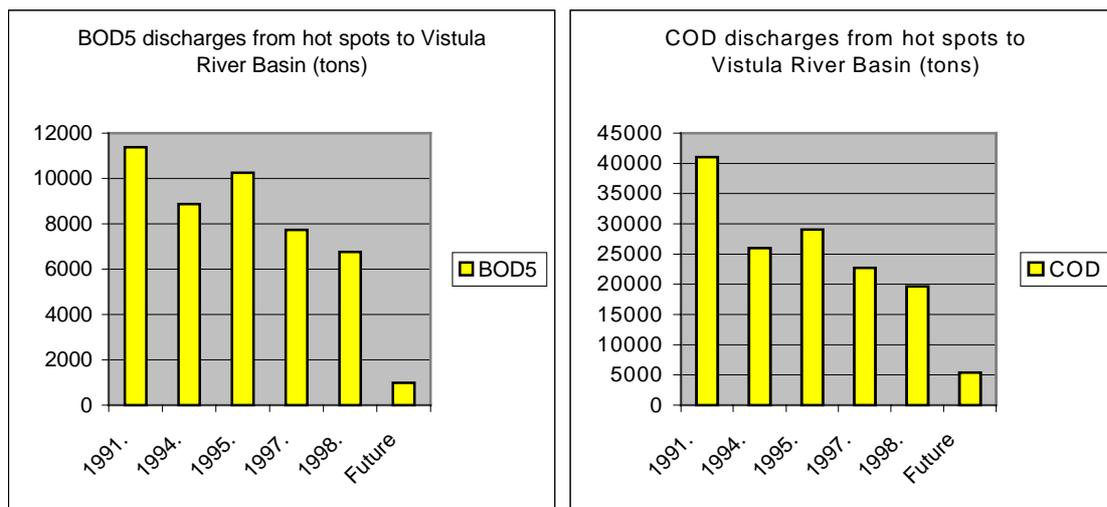


Figure 4.7. Waste water discharges of BOD<sub>5</sub> and COD from industrial hot spots to the Vistula River Basin (tons) (7 hot spots).

Waste water discharges and air emissions were considerably reduced in the area, mainly due to successful environmental projects. After completing the ongoing projects the discharges will be reduced significantly (see figure 4.7). The emissions of SO<sub>x</sub> into the air were reduced 29 % and NO<sub>x</sub> 15 % between 1991-98.

#### 4.5.3.3 Investments in the area

Investments of 27 MEUR have been allocated on environmental projects at industrial hot spots. The total cost estimate to implement the recommended measures was 77 MEUR.

#### 4.5.3.4 Status of hot spots

##### Hot Spot No. 77 Country: Poland; Name: Frantschach Swiecie S.A. pulp and paper mill

**Aim:** Reduction of pollution load

**Description:** Frantschach is a pulp and paper mill, which was selected as a hot spot due to the high pollution load. The mill discharged 7 000 tons of BOD<sub>5</sub> and 23 500 tons of COD in 1991. It also released 4 700 tons of SO<sub>x</sub> and 3 300 tons of NO<sub>x</sub>

to the air. The measure proposed to reduce the pollution load was the modernisation of the existing waste water treatment plant. The original cost estimate for reducing discharges and emissions was 13 MEUR.

**Development:** The waste water discharges and air emissions have been reduced considerably between 1991-1998. BOD<sub>5</sub> discharges have been reduced by 94 % and COD discharges 93 %. Air emissions of SO<sub>x</sub> were reduced by 36 % and NO<sub>x</sub> emissions by 49 %. From January 1999 the production of bleached pulp has been stopped and the plant produces only unbleached pulp. The modernisation of the causticisation was carried out between 1991-94 with support from Finnish donors and consultants. Investments in the WWTP have been directed to implement a secondary treatment stage for waste water discharges. From 1999 onward waste waters are treated both biologically and chemically, and the concentrations of pollutants are expected to comply with the limit values of HELCOM recommendations except for the P<sub>tot</sub> discharges. A monitoring programme has been established and implemented. The programme covers waste water and air emissions monitoring as well as the monitoring of contamination of ground water in the buffer zone and beyond. The new cost estimate for improvements of the technology is 4,1 MEUR of which 3,3 million has already been invested.

**Hot Spot No. 79 Country: Poland; Name: WWTP Bydgoszcz "Kapusciska" chemical industry**

**Aim:** Reduction of heavy metals

**Description:** Bydgoszcz is a chemical industry plant and was selected as a hot spot due to the high discharges of waste water and air emissions. Actually the WWTP "Kapusciska" processes both municipal waste water as well as industrial waste water, even though it is listed as industrial on a hot spot list and handled by Finland as a lead country. It might be more relevant to include this hot spot under the combined municipal and industrial element with Sweden as lead country. In 1991 the plant discharged 922 tons of N<sub>tot</sub> and 102 tons of P<sub>tot</sub>, 4 189 tons of BOD<sub>5</sub> and 10 541 tons of COD. The plant has been a considerable polluter in the Vistula River Basin area. The measures proposed for the reduction of pollution were the modernisation of the waste water treatment plant, improved air pollution control and waste management. The cost estimate was originally almost 43 MEUR.

**Development:** The waste water discharges of the plant have stayed at about the same level between 1991-1998. There is an environmental project ongoing (1997-2000) to construct a mechanical and biological WWTP. The new WWTP is estimated to reduce waste water discharges considerably, BOD<sub>5</sub> by more than 90 %, COD by more than 80 %, N<sub>tot</sub> by 15 % and P<sub>tot</sub> by more than 60 %. The new cost estimate for the improvements to meet the HELCOM JCP criteria is 45 MEUR, of which 6,4 MEUR has been allocated for the ongoing project. The allocated capital is from local sources (16,6 MPLN), provincial (16 MPLN), national (80 MPLN) and international sources (25 MPLN) and own capital (51 MPLN).

**Hot Spot No. 89 Country: Poland; Name: "Organika-Azot" Chemical Plant in Jaworzno**

**Aim:** Reduction of air pollution, waste and waste water

**Description:** Organika-Azot is a chemical plant which manufactures pesticides. The plant was selected as a hot spot due to waste water problems and high emissions to the air. In 1991 the plant discharged 0,8 tons of metals, and pesticides like beta-HCH, DDT, HCH and lindane, but the amounts of harmful substances are

not reported. The measures proposed for the reduction of pollution load were the modernisation of the waste water treatment, air pollution control and waste management. The cost estimate for the improvements of the plant was 1,7 MEUR.

**Development:** The waste water discharges of BOD<sub>5</sub> and COD have decreased considerably, BOD<sub>5</sub> by 55 % and COD by 80 %. It is not possible to estimate the development of discharges of harmful substances due to the lack of data. The new cost estimate for the modernisation of the plant is 0,8 MEUR of which 0,6 MEUR have been allocated. The modernisation of the waste water treatment technology is planned as well as the modernisation of the production line for insecticides. The elimination of the use of chlorine is completed and the landfill has been improved.

### **Hot Spot No. 90 Country: Poland; Name: "Boruta" Dyestuffs Plant in Zgierz**

**Aim:** Reduction of discharges

**Description:** Boruta is a plant, which manufactures intermediate products by an organic dyestuff synthesis. In 1991 the plant discharged 1 700 tons of COD and 2,8 tons of metals. The waste waters are treated at the Zgierz city WWTP. The plant also released 1 900 tons of SO<sub>x</sub> and 1 200 tons of NO<sub>x</sub> into the air. The measures proposed for the reduction of discharges was a modernisation of the plant's waste water treatment. The cost estimate for the modernisation of the plant was originally estimated to be 3,5 MEUR.

**Development:** The waste water discharges have decreased considerably between the years 1991-1998, COD and metals decreased by about 70 %. Also air emissions have been reduced, SO<sub>x</sub> by 16 % and NO<sub>x</sub> by 24 %. The favourable development is presumably due to implemented measures at the plant. Technical assistance and investments are still ongoing at the plant. The cost estimate for the improvements at the plant was raised to 18 MEUR and 16,8 MEUR has already been allocated between the years 1993-1999. The project on waste management is already completed and the improvement of the waste water pollution control is ongoing (construction of a WWTP in Zgierz city). After the completion of the WWTP it is expected the relevant requirements of HELCOM recommendations are complied with.

### **Hot Spot No. 91 Country: Poland; Name: Oswiecim -Chemical plant "Dwory"**

**Aim:** Reduction of air pollution and waste water discharges

**Description:** Dwory is a chemical plant, which was selected as a hot spot due to high waste water discharges. In 1991 the plant discharged 3 500 tons of COD, 81 tons on N<sub>tot</sub>, 2,1 tons of P<sub>tot</sub> and 8,5 tons of metals in waste water. The plant also released 5 000 tons of SO<sub>x</sub> and 1 700 tons of NO<sub>x</sub> into the air. The measures proposed for the reduction of the pollution load were more effective waste water treatment and improved air pollution control. The original cost estimate for the modernisation of the plant was estimated to be 16,5 MEUR (later reduced to 5 MEUR).

**Development:** The waste water flow of the plant decreased 60 % between 1991-1998, which may indicate reduced production. The waste water discharges of BOD<sub>5</sub> and COD were reduced considerably, by 25 % and 80 %. The discharges of N<sub>tot</sub> and P<sub>tot</sub> were on the contrary increasing, N<sub>tot</sub> to 139 tons (72 %) and P<sub>tot</sub> to 12,4 tons (490 %). The discharges of metals were reduced to 2,2 tons (74 %). SO<sub>x</sub>-emissions have been reduced to 3485 tons (30%), but NO<sub>x</sub> emissions have increased to 2675 tons (57%). A set of remedial actions were taken and planned for 1991-1994, which included 1) the equipping of the heat generating plant with electrostatic precipitators 2) the construction of a landfill 3) the construction of a

new waste water treatment plant with sludge dewatering. The cost estimate for these measures was 20 MEUR (HELCOM PITF 7/95). A study on "enhanced programme of pollutants emissions limitation" was carried out after that, supported by Finland (HELCOM PITF 10/97). There is a lack of funds to make investments.

**Hot Spot No. 92 Country: Poland; Name: Mining and Metallurgic Works "Boleslaw" in Bukowno**

**Aim:** Reduction of air pollution, waste and waste water discharges

**Description:** Boleslaw is an industrial plant operating in the mining and steel industry sector, located in the region of Bukowno. It was selected as a hot spot due to high emissions into the air and discharges to the waters and unsatisfactory waste management. In 1991 the plant discharged 1 700 tons of COD, and also a considerable amount of metals, 450 tons of zinc and 4 tons of lead. The plant also released 4 400 tons of SO<sub>x</sub> and 18 tons of zinc into the air. The measures proposed to reduce pollution load were the modernisation of the waste water treatment plant, improved air pollution control and waste management. The cost estimate for the modernisation of the plant was originally 7 MEUR (reduced to 3,3 MEUR in 1996).

**Development:** The waste water discharges were reduced considerably between 1991-1998, COD discharges were reduced 65 %, zinc discharges 39 % and lead discharges 50 %. Emissions of SO<sub>x</sub> into the air were reduced by 35 %. This progress is mainly due to the implemented environmental projects. There is technical assistance and investments still ongoing at the plant that were to be finalised in December 2000. Investments have already been incurred on pressure filters (1992, supported by Finland) and the refurbishment of technology has been implemented between 1990-97 with Swedish equipment. (HELCOM PITF 10/97) The ongoing project includes water pollution control: 1) protection against clean water pollution connected with Boleslaw and Olkusz mines closure. 2) a project on waste water treatment in the lower part of the mine (settling tank construction, water galleries and headings adaption) and 3) the monitoring of groundwater and surface water. The project also includes air pollution control: 4) a modernisation of the zinc oxide plant 5) a modernisation of the zinc electrolysis department and 6) the prevention of secondary emissions from the settling ponds. The ongoing project also includes waste management: 7) the utilisation of process wastes (almost 100%) in mine headings and embankment building for the settling ponds. The implementation of the project was planned to be ready by 1996 at an estimated cost of 1,64 MEUR (HELCOM PITF 7/95), but no information has been received on the success of the project.

**Hot Spot No. 96 Country: Poland; Name: Upper Vistula River basin salt control**

**Aim.** Reduction in saline mining water discharges from hard coal mines

**Description:** The Upper Basin is a coal and sulphur mining area. In 1990 the coal mines discharged large amounts of salt which made the Vistula river water unsuitable for the abstraction of drinking water all the way to Warsaw. The water was too corrosive for industrial use as well. The discharges of chlorides and sulphites from the coal and sulphur mines in the Upper Basin were recognised as considerable. As a result of the salinity and other pollution, expensive long distance water supply systems were built in the upper and middle Vistula region, which diverted investment resources from cleaning up the causes of river pollution. The restructuring of the mining industry was seen as essential and was under investigation in 1990 (HELCOM 1993a). The reported chloride discharges were 190 400 tons and

the sulphite discharges 28 000 tons in 1994. About one third of the total 61 000 000 m<sup>3</sup> of waste water was treated in 1994. The total cost estimate for the reconstruction was 620 MEUR in 1990.

**Development:** It is impossible to assess the development because of lacking data. By 1995 some technical assistance was reported and a salt control inventory was ongoing. Investment actions have been planned by 2005, but no investments have been made so far.

## 4.6 Oder/Odra River Basin

### 4.6.1 Hot spots

There are eight industrial hot spots in the area, of which four are classified as priority hot spots. All priority hot spots are large industrial areas with various industries.

### 4.6.2 Discharges to Oder/Odra River Basin

Figure 4.8 on discharges and emissions from the area include data of both official hot spots and industries studied in the Hot spot review in 1994.

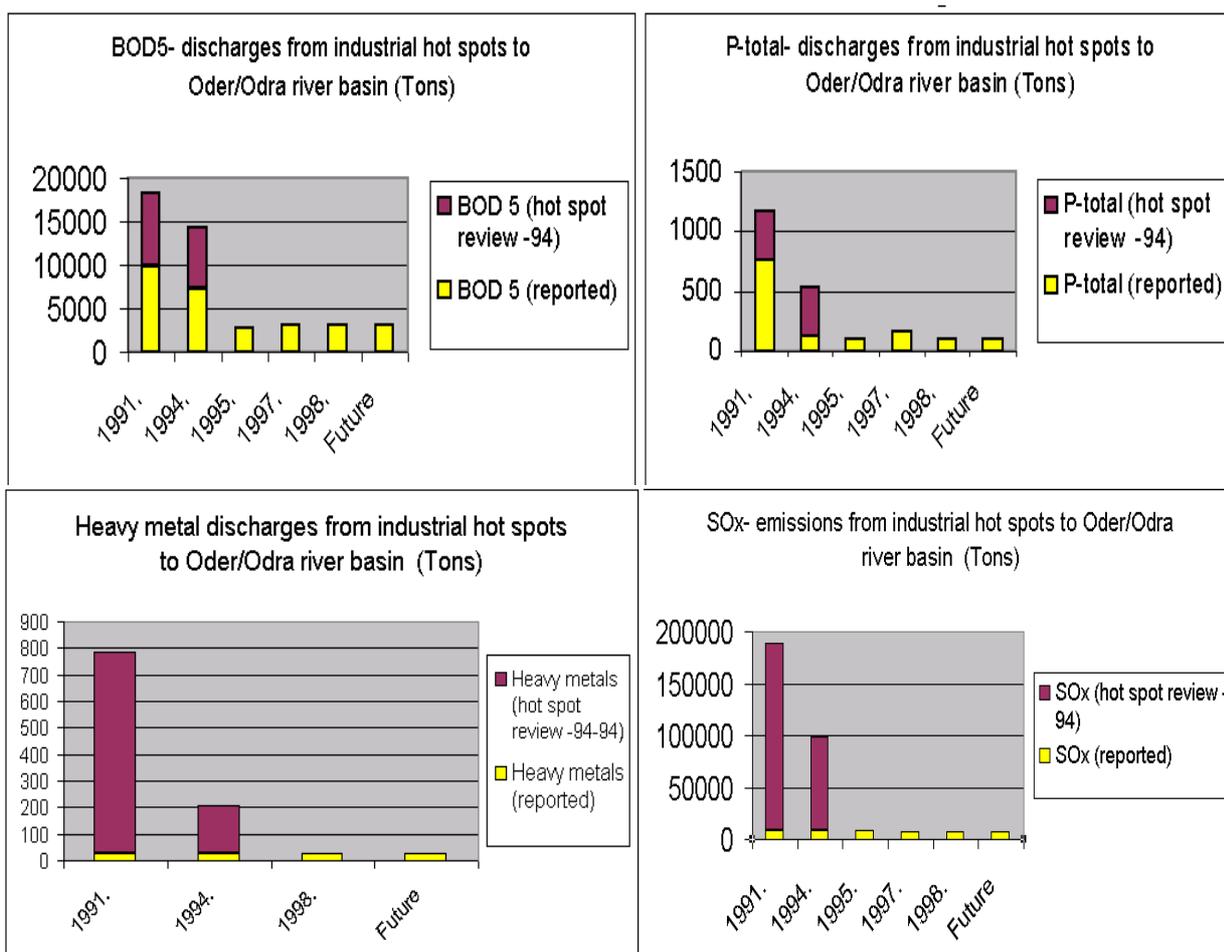


Figure 4.8. Waste water discharges of BOD<sub>5</sub>, P<sub>tot</sub> and heavy metals, and air emissions of SO<sub>x</sub> from industrial hot spots in Oder/Odra river basin (tons) (8 hot spots).

Most of the reduction in waste water discharges and air emissions are due to reduced production. Some minor improvements have also been made in several of the individual plants included in the hot spots with multiple industries.

#### 4.6.3 Investments in the area

The cost estimate for the area to meet the HELCOM JCP criteria was estimated to be 175 MEUR. Investments of only 30 000 EUR have been reported, but some investments may be missing from the reported amounts. The reported activities are mainly technical assistance nature, and full scale reconstruction of the old facilities have not been done.

#### 4.6.4 The status of hot spots

##### Hot Spot No. 98 Country: Poland; Name: Szczecin (chemical and pulp & paper) PRIORITY HOT SPOT

**Aim:** Reduction of emissions

**Description:** According to the preliminary study Szczecin is an area with multiple industries. Three of the industrial plants in the area were included in the hot spot list. All industries discharge the waste waters to the Odra river. The plants have different kind of waste water treatment in use depending on the pollutants. In 1991 a major part of the wastewater from the industries was connected to the municipal sewer systems, and since no municipal treatment plant has been constructed (by 1994) the wastewater was only undergoing pretreatment, if any, before being discharged to the Odra river. The reported discharge load in wastewater from the three industries was 610 tons of BOD<sub>5</sub>, 52 tons of P<sub>tot</sub> and 30 tons of N<sub>tot</sub> in 1991. Most of the phosphorous came from one fertiliser plant (Police) that was the dominating source of phosphorous discharges to the Odra river (BSEP 1994g). One of the three sub-hot spots (fish processing plant P.P.U "Gryf") was deleted in 1996 from a hot spot list after it was closed down. The third sub-hot spot in the area is a pulp and paper plant "Szczecin-Skolwin".

The measures proposed to reduce the pollution load were the modernisation of waste water treatment, improvement of the air pollution control and the waste management. Originally it was estimated that the investments needed to fulfil HELCOM JCP criteria would be about 13 MEUR, but more recent cost estimates are lower.

**Development:** It seems that the amounts of discharges have varied significantly between 1991-1998. In three sub-hot spots the amount of discharges dropped considerably between 1991-1994 but increased after that. In some cases the reductions from 1991-1994 are due to implemented measures, such as increased recycling of water and the upgrading of the WWTPs. However, most of the variation in pollution seems to be connected with the variation in production (BSEP 1994g). At the chemical plant "Police" there are several investments ongoing or completed. **Ongoing:** 1) the construction of a band conveyor for salt transport, 2) desulphuration of gases to reduce SO<sub>x</sub>-emissions, 3) the reuse of FeSO<sub>4</sub>. **Completed:** 4) the shifting to low emission burners to reduce NO<sub>x</sub>- and dust-emissions 5) continuous monitoring of the heat power plant. **Planned:** 6) the automation of immission stations 7) new piezometers for the FeSO<sub>4</sub> dump. The reported P<sub>tot</sub> discharges from "Police" were reduced to 20 tons (95 % reduction compared with the preliminary study). Investments were not reported. There has also been an environmental pro

ject ongoing at the paper mill "Szczecin-Skolwin" S.A. which includes: 1) the construction of a biological WWTP for municipal and industrial waste waters and 2) a plan to construct a fluidised bed boiler. 0,02 MEUR has been allocated and 2,08 MEUR is planned to be invested. The remaining needed investments are planned to come from foreign funds (0,17 MEUR), from the central and local government (1,13 MEUR from National Fund for Environmental Protection and Water Management, Provincial fund for environmental protection and water management) and from own funds (0,7 MEUR) (BSEP 1994g).

**Hot Spot No. 102 Country: Poland; Name: Legnica-Glogow (Copper Mining, Fertiliser (N) and Food Processing) PRIORITY HOT SPOT**

**Aim:** Reduction of air pollution, waste and waste water

**Description:** According to the preliminary study this is an area with several industries, mainly copper mines, non-ferrous metal, chemical, fertiliser, food and leather industry, altogether 11 different industrial plants, but only three of them (copper mining, fertiliser and food processing industries) have finally been included in the hot spot list. Most of the large industries discharge directly to the Odra River and a few to the tributaries of the Odra River. The hot spot is located 350 km from the Baltic coast (BSEP 1994g). One of the plants has been officially included in the hot spot list by Poland, a poultry food processing plant. Two copper mines have been proposed to be officially included in the hot spot list by Poland. Fertiliser industry is proposed by Poland to be deleted from the hot spot description as due to economical changes it does not exist in the area any longer.

The environmental impact of the waste water is related to the content of chloride (copper mines), organic material (chemical and sugar industry) and phosphorous (fertiliser industry). The reported pollution load from the hot spot in 1991 was 293 tons of tot-P and 242 tons of  $N_{tot}$ . Most of the  $N_{tot}$  was from the copper mines Gornicze Rudna and Konrad (BSEP 1994g). The measures proposed for the reduction of the pollution load were a modernisation of waste water treatment, air pollution control and waste management. The total cost estimate was 120 MEUR.

**Development:** The waste water discharges and air emissions have decreased considerably since the beginning of the 90's. Between the years 1991-1994 all important air and water discharges were reduced from 16 % ( $BOD_5$ ) to 98 % (lead). Some of the development was due to the reduction in production, and some has been due to the process technology developed. The air emissions from the two copper refineries were also reduced in the area between 1991-1994,  $SO_x$ , dust,  $NO_x$  and lead -emissions were reduced by 30-50%. Most of the reductions were due to the reduced production (BSEP 1994g). No major changes in reported industrial discharges have occurred after 1994. Investments have been planned, but because of lacking resources they have not been implemented.

**Hot Spot No. 104 Country: Poland; Name: Wroclaw (Chemical, food, textiles)**

**Aim:** Reduction of discharges and emissions

**Description:** Wroclaw is a hot spot with multiple industries in the area, chemical, food processing and textile industry. In 1991 the reported discharges from the area consisted of 6 200 tons of  $BOD_5$ , 14 500 tons of COD and 30 tons of metals (not specified). The industries also released 1 510 tons of  $SO_x$  and 8 700 tons of  $NO_x$  to the air. The measures proposed to reduced the pollution load were a modernisation of the waste water treatment, air pollution control and waste management. The cost estimate for the reduction of the discharges was 19,6 MEUR (HELCOM 1999a).

**Development:** There has been a considerable reduction in waste water discharges in the area between 1991-1998. Most of the development is due to reduced production. The total waste water flow decreased 75 % between 1995-1998. BOD<sub>5</sub> discharges have decreased by 99,8 % and COD discharges by 74 %. This indicates a major reduction in production. Emissions of SO<sub>x</sub> decreased by 39% and NO<sub>x</sub>-emissions by 89%. No investments have been made in the area, but there is an environmental programme defined which was planned to be implemented by 2000 with local investments. (HELCOM 1999a).

**Hot Spot No. 105 Country: Poland; Name: Phosphate Fertiliser plant "Uboz"**

**Aim:** Reduction of discharges

**Description:** The "Uboz" fertiliser plant was selected as a hot spot because of high discharges of heavy metals. The plant has not reported discharges of heavy metals since 1991. Other discharges in 1991 were 0,3 tons of BOD<sub>5</sub>, 3 tons of COD and 0,02 tons P<sub>tot</sub>. The plant also released 9 tons of SO<sub>x</sub> and 3 tons of dust into the air. The cost estimate for the modernisation of the waste water treatment and for the reduction of heavy metals was 0,8 MEUR.

**Development:** Between 1991-1998 the production has reduced further, the waste water flow decreased by 50 % and also waste water discharges of pollutants and air emissions decreased between 25-90 %. The plant has a water pollution control plan and a technical design project was implemented in 1997. Due to the lack of funds there has not been any investments made in the plant to reduce discharges.

**Hot Spot No. 106 Country: Poland; Name: Chemical plant "Wizow" in Boleslawiec**

**Aim:** Reduction of phosphorous load

**Description:** Wizow is a fertiliser plant which was selected as a hot spot due to its high discharges of phosphorous. The discharges were 410 tons of phosphorous in 1991 (HELCOM 1996). The cost estimate for the modernisation of the plant's water management was 0,8 MEUR.

**Development:** The discharges of the plant have decreased considerably between 1991-1998. The amount of phosphorous has dropped to 3,8 tons (99 %) and the waste water flow was reduced by almost 50 % between 1994-1998. Most of the reduction is hence due to reduced production. A project on waste water treatment to reduce the discharges of phosphorous is ongoing, and the requirements of relevant HELCOM recommendations were expected to be complied with by the end of 2000. The investment cost of the project is estimated to be 500 000 EUR.

**Hot Spot No. 108 Country: Poland; Name: Katowice-West (various industries) PRIORITY HOT SPOT**

**Aim:** Reduction of discharges and emissions

**Description:** Katowice-West is an industrial area located in southern Poland. The area comprises large industrial centres located in or near Katowice within the Odra river basin. There is a population of several million inhabitants, located in numerous communities centred around large industrial complexes. The industries in the area are the source of heavy contamination of both the air and water in a local and a wider scale. The pollutants of concern include nitrogen compounds, sulphur dioxide, heavy metals and certain chemical compounds (BSEP 1994g).

According to the preliminary study, the industries in the area constitute of five separate plants. Poland has reported only scarce data from the area, and the revision of the sub-hot spots is on the way. In 1991 there were reported discharges of 670 tons of BOD<sub>5</sub> and 2 796 tons of N<sub>tot</sub>. The discharges of metals and air emissions were not reported. The cost estimate for the modernisation of the plants was originally 8,8 MEUR.

**Development:** It is difficult to assess the development due to the lacking data. The reported discharges of N<sub>tot</sub> were reduced to 1 810 tons (-35 %) between 1991-1994.

**Hot Spot No. 110 Country: Czech Republic; Name: Ostrava area (various industries) PRIORITY HOT SPOT**

**Aim:** Cost effective water pollution abatement

**Description:** The Ostrava area in the North-Eastern part of the Czech Republic is a large area with a number of large industries. The population of the region was 1,4 million in 1994 and it is one of the most densely polluted areas in the country. The industries discharge waste waters to the Olse, the Ostravice and the Lucina Rivers, which are tributaries to the Odra River. The hot spot is located near the borders of Poland and Slovakia, close to the source of the Odra river. It comprises coal mines, iron-steel works, coke plants, chemical industry plants, pulp and paper mills as well as power plants. The preliminary study identifies 14 different industrial plants. High emissions of SO<sub>x</sub> and NO<sub>2</sub> to the air are also characteristic to the area, but no relevant data on this was attained in the preliminary study or elsewhere. The environmental impact of the waste water is mainly related to the content of chloride (coal mines), organic material (chemical and paper industry) and phenol (coke and iron & steel industry). The industries apply primary and secondary treatment depending on the nature of the pollutant in the wastewater (BSEP 1994g).

The reported total discharges to water were 2 300 tons of BOD<sub>5</sub> and 1 712 tons of N<sub>tot</sub> in 1991. The load was 2,5-4 times higher compared to the requirements of relevant HELCOM recommendations. The metal industries in the area also discharged a substantial amount of heavy metals. The discharges were 470 tons of zinc, 5 tons of copper and 1 ton of lead. The cost estimate for the planned projects was 30,8 MEUR, and to fulfil all requirements of the HELCOM JCP criteria, the estimate is 30 MEUR higher. The proposed measures included for example the construction and upgrading of the WWTP. The cost estimates for air pollution control were not made due to the lack of data (BSEP 1994g).

**Development:** The load of BOD<sub>5</sub> and N<sub>tot</sub> decreased by 40 % and 20% respectively between the years 1991-1994. The discharges of heavy metals were also reduced due to reduced production. The industries in the Ostrava area were in the middle of a privatisation process in 1994 and it was difficult to make long term plans on pollution control (BSEP 1994g). The most recent data from the Ostrava area is from the year 1994, and it is not possible to estimate the development after that.

**Hot Spot No. 111 Country: Czech/Poland; Name: Upper Odra River basin salt control**

**Aim:** Reduction of saline mining water discharges from hard coal mines

**Description:** (See also hot spot No. 96) The upper basin is an area of coal and sulphur mines on both sides of the Czech/Polish border. The area was selected as a hot spot because of its high discharges of saline and sulphite waste water. The only available data for the hot spot is from the year 1995, when the discharges were 190 400 tons of chlorides and 28 000 tons of sulphites. The cost estimate is not available.

**Development:** Due to lacking data it is not possible to estimate the development. There is an investigation ongoing on salt control which is planned to be implemented by 2005 (HELCOM PITF 10/97).

## 4.7 Kattegat

### 4.7.1 Hot spots

There was originally one hot spot in the area, a pulp and paper mill. It was deleted from the hot spot list due to substantial reduction in discharges.

### 4.7.2 Discharges to Kattegat

The waste water discharges from the single hot spot in the area have reduced considerably after the deletion from the hot spot list. The discharges of AOX are for example only a fraction of the former situation.

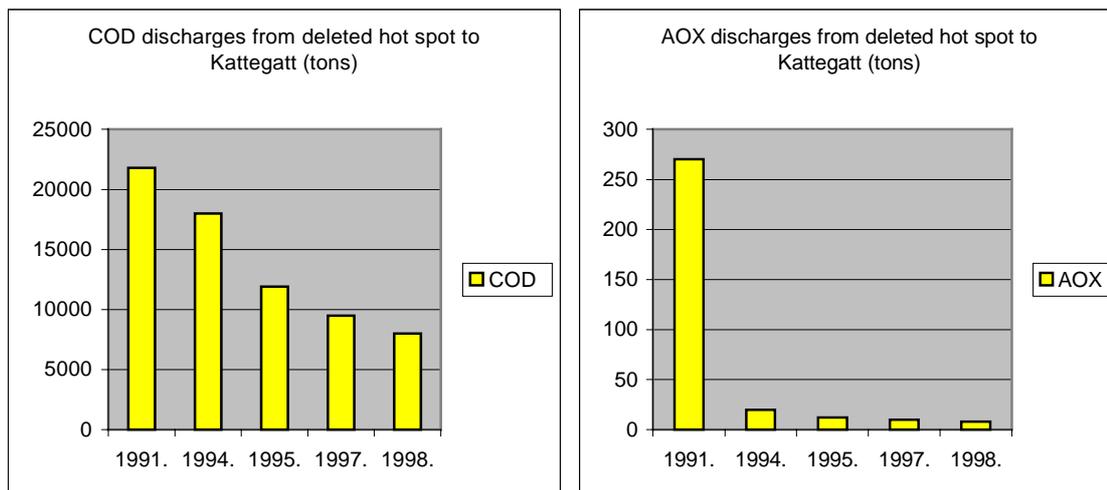


Figure 4.9. Discharges of COD and AOX to Kattegat from industrial deleted hot spot.

### 4.7.3 Investments in the area

The pulp and paper mill has implemented the recommended measures. The cost estimate was 40 MEUR.

### 4.7.4 Status of hot spot

**Hot Spot No. 126 Country: Sweden Name: Skoghall pulp and paper mill**

**Aim:** (Reduction of chlorinated substances) Deleted hot spot -94

**Description:** The Skoghall pulp and paper mill was selected as a hot spot due to high discharges of chlorinated substances. The mill produced 238 tons of pulp in 1998. The discharges of AOX were 270 tons and the discharges of COD 21 800 tons

in 1991. The mill discharged also 200 tons of  $N_{tot}$ , 15 tons of  $P_{tot}$  and 5391 tons of  $BOD_5$ . The measures proposed for the plant for removal from the hot spot list were the installation of oxygen delignification and bleaching without chlorine gas. The cost estimate for the plant to meet HELCOM JCP criteria was 40 MEUR.

**Development:** Skoghall was deleted from the hot spot list in 1994 after it had achieved substantial reduction in discharges. By 1998 AOX emissions were reduced to 8 tons (97%), COD to 8 010 tons (63%),  $N_{tot}$  to 117 tons (42%) and  $BOD_5$  to 2 074 tons (62%) from the year 1991. Only the amount of  $P_{tot}$  increased, to 19 tons (27%).

## 4.8 Bornholm Basin

### 4.8.1 Hot spots

One sulphite pulp and paper mill was selected as a hot spot from the area.

### 4.8.2 Discharges to Bornholm Basin

The waste water discharges from the plant were considerably reduced and the discharges of AOX have been almost eliminated. The plant has reduced its discharges further after its deletion from the list.

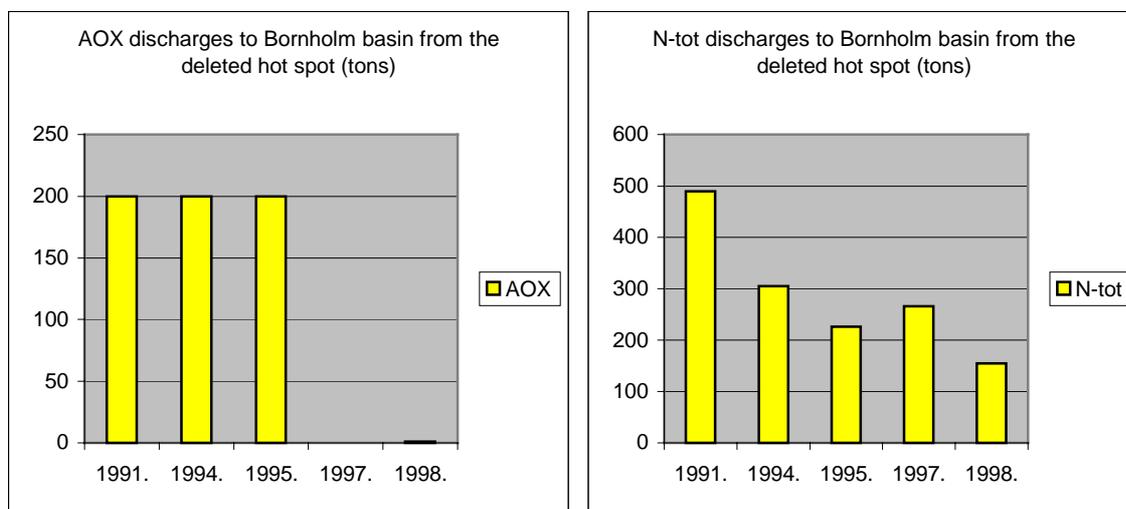


Figure 4.10. Discharges of AOX and  $N_{tot}$  to Bornholm Basin from industrial deleted hot spot (tons).

### 4.8.3 Investments in the area

The required measures to meet HELCOM JCP criteria were implemented, and the hot spot was deleted from the list. The costs of the implementation of the proposed measures were originally estimated to be 14 MEUR.

#### 4.8.4 Status of hot spot

**Hot Spot No.131 Country: Sweden; Name: Nymölla pulp and paper mill**

**Aim:** (Reduction of nutrient discharges) Deleted hot spot -96

**Description:** Nymölla is a sulphite pulp and paper mill, which was selected as a hot spot due to the high discharges of nutrients. The mill produced 297 tons of pulp in 1998 and the discharges were 490 tons of  $N_{tot}$ , 52 tons of  $P_{tot}$  and 6 174 tons of  $BOD_5$  in 1991. The discharges of AOX were 200 tons and the discharges of COD 44 400 tons. The mill was the second biggest discharger of COD among all industrial hot spots in 1991. The measures proposed to meet HELCOM JCP criteria were a conversion of the aerated lagoon to an activated sludge treatment plant. The cost estimate for the proposed measures was 14 MEUR.

**Development:** Nymölla was deleted from the hot spot list in 1996 after it had achieved a substantial reduction in discharges. The discharges of  $N_{tot}$  were reduced 68 %,  $P_{tot}$  discharges 71 %,  $BOD_5$  discharges 98%, COD discharges 69 % and AOX discharges 99,5 %. Nymölla constructed an activated sludge plant in 1993 and an ultrafiltration stage in 1995. According to HELCOM PITF 8/96 the investments were financed by Swedish EPA.

# The development of discharges and emissions by industrial sectors

# 5

## 5.1 Pulp and paper industry

Hot Spot No.	Priority	Country	Name	Environmental Investment Activity
2		Finland	Metsä-Botnia OY Kemi pulp and paper mill	DELETED -94
3		Sweden	Husum Kraft mill pulp and paper mill	DELETED -94
4		Sweden	Ostrand pulp and paper mill	DELETED -94
5		Sweden	Vallvik pulp and paper mill	DELETED -94
11		Finland	YPT Joutseno pulp and paper mill	DELETED -94
12		Finland	Kaukas Lappeenranta pulp and paper mill	DELETED -94
13		Finland	E-G Kaukopää pulp and paper mill	DELETED -94
14		Russia	Syasstroi pulp and paper mill	YES, 1.14 of 34 MEUR allocated
16		Finland	Sunila OY Kotka pulp and paper mill	DELETED -97
27		Estonia	Horizon Ltd, Kehra p&p mill	YES, 0,3 of 0.7 MEUR allocated
29		Estonia	Tallinn pulp and paper mill	DELETED -94 (Production stopped)
38	X	Latvia	Sloka pulp and paper mill	NO PRODUCTION
49	X	Russia	Sovetsk pulp and paper mill	YES, 26 of 64 MEUR allocated
50	X	Russia	Neman pulp and paper mill	YES, 1 of 7 MEUR allocated
64		Lithuania	Klaipeida cardboard factory	NO PRODUCTION SINCE -94
68		Russia	Kaliningrad Pulp & Paper Mill No.1	DELETED -98 (Production stopped)
69		Russia	Kaliningrad p&p mill No.2	YES, 0,9 of 1,4 MEUR allocated
77		Poland	Frantschach Swiecie S.A. p&p mill	YES, 3,3 of 4 MEUR allocated
98/2		Poland	Szczecin-Skolwin pulp and paper mill	YES, 1,5 of 3,3 MEUR
126		Sweden	Skoghall pulp and paper mill	DELETED -94
131		Sweden	Nymölla pulp and paper mill	DELETED -96

There were originally 21 pulp and paper mills, which were selected as hot spots throughout the catchment area. By 1999 12 of them have been deleted from the hot spot list, 10 mills because of implemented pollution control measures and two mills because production has ended. The development of process technology in the industrial sector has been significant and the discharges of AOX and COD have been reduced considerably, especially in the deleted Finnish and Swedish hot spots. The change of bleaching process has resulted in a substantial reduction of discharges of chlorinated substances (AOX) (See figures 5.1-5.3). The biological treatment of waste waters has also increased considerably. The emissions of SO<sub>x</sub> have been reduced by increasing the dry content of incinerated black liquor and also by the application of electrostatic precipitator and other technical equipment. The discharges of the sector have also been reduced due to the reduced production in the mills located in the countries in transition. Two plants have ended their production permanently and two plants are temporarily closed.

The requirements on AOX in the HELCOM recommendation on pulp industry are fulfilled in general at the mills. The requirements in the new HELCOM recommendation (17/8) for COD are not yet complied with (in 1998) as an average for the sector. The estimates in figures 5.2-5.5 are based on production data from 1998. The comparison between HELCOM-discharges and real discharges (discharges/ production in 1998) is made for each pulp and paper plant separately, and separate

figures are added up to receive total figures in western and eastern plants. The required discharge level both the deleted (OLD 11/2) and the present HELCOM recommendations (NEW) are shown. The present recommendations are expected to be complied with in 2000 in western plants and in 2005 in countries in transition.

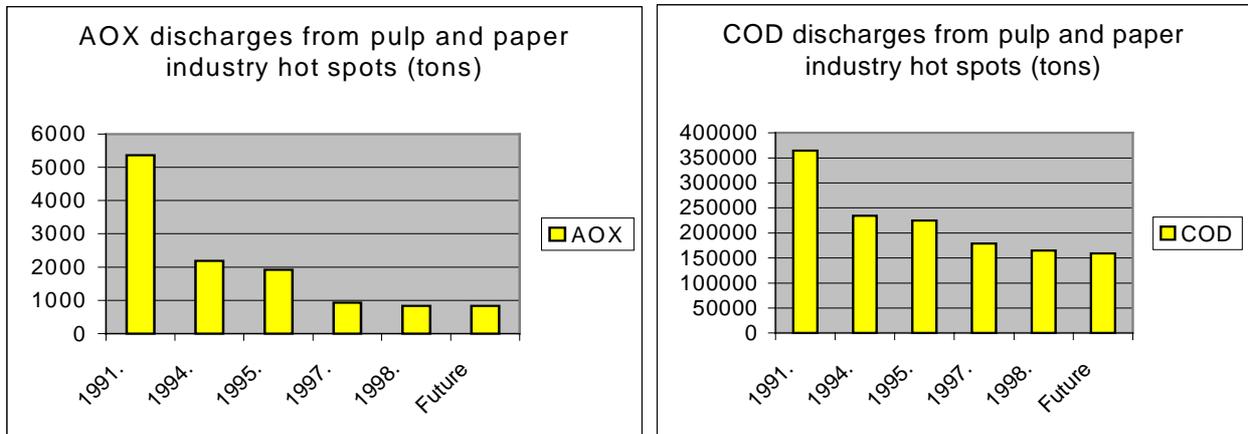


Figure 5.1. Discharges of AOX and COD (tons) in the pulp and paper industry.

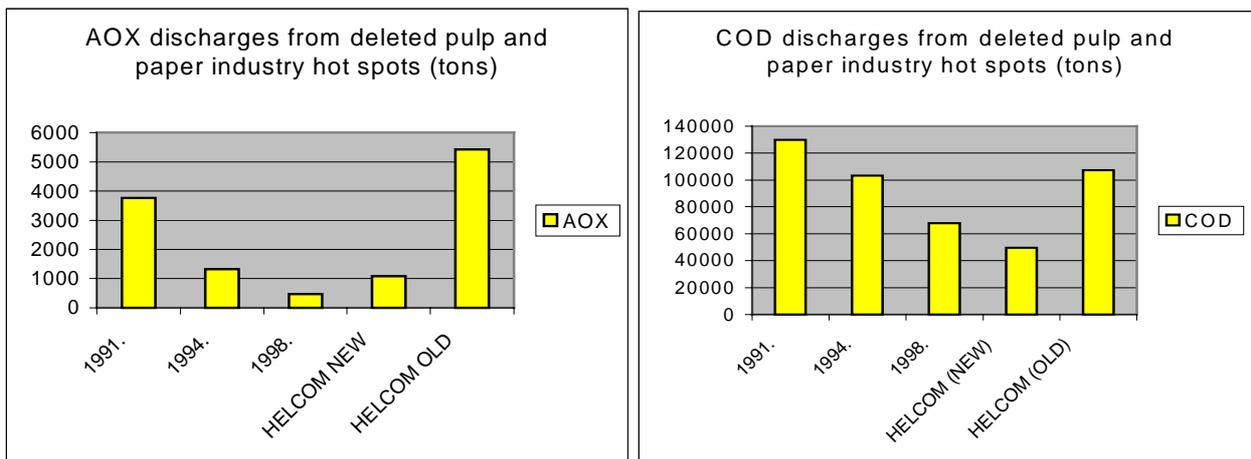


Figure 5.2. Comparison of the discharges of COD and AOX with the requirements in HELCOM recommendations (11/2, 17/8 & 17/9) for western pulp and paper mills.

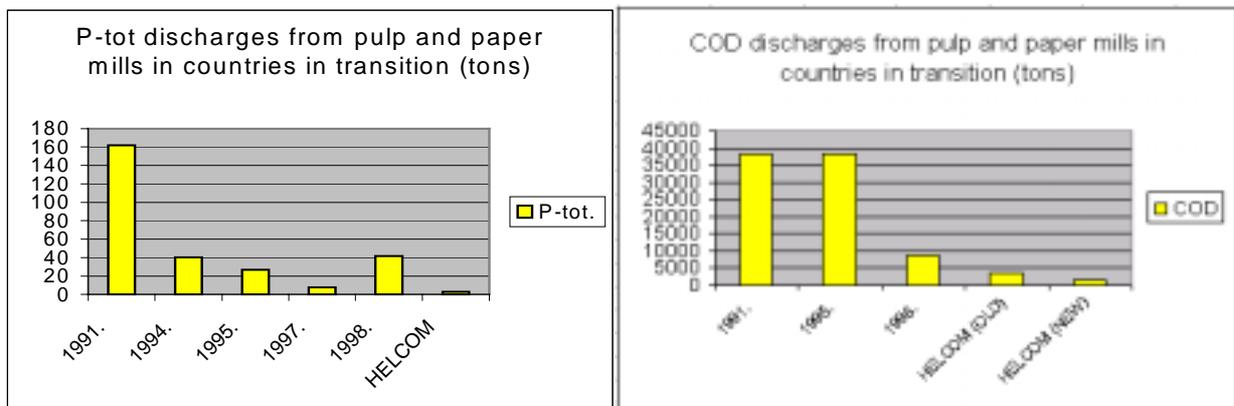


Figure 5.3. Comparison of the discharges of COD and AOX with the requirements in HELCOM recommendations (11/2, 17/8 & 17/9) from pulp and paper mills in countries in transition (three Russian and one Estonian plant). The required discharge levels of both the old and new HELCOM recommendations are shown.

The hot spots in countries in transition face problems in achieving requirements of the HELCOM recommendations for pulp industry (17/8 and 17/9) (figure 5.3). The situation is better in Poland, where a lot of environmental efforts have been made, and one out of two pulp and paper mills included on the JCP Hot-spot list fulfil requirements of HELCOM recommendations for both COD and AOX. (HELCOM 1999b).

The pulp and paper mills in the countries in transition have already allocated a total amount of 32 MEUR for environmental projects during 1991-1998, while the total cost estimate for the plants to meet the JCP goal was 141 MEUR. This figure does not include the deleted hot spots. In the Finnish and Swedish plants the necessary investments have been made to meet the HELCOM JCP criteria. The cost estimate for the plants in Sweden and Finland was about 222 MEUR.

## 5.2 Metal industry

Hot Spot No.	Country	Name	Environmental Investment Activity
1	Sweden	Rönnskärsverket metal smelter	YES, 45 of 45 MEUR allocated
7	Finland	Outokumpu Harjavalta metals	YES, 4,4 of 4,7 MEUR allocated
15	Russia	Volkhov metal smelter	YES, 1,6 of 2,8 MEUR allocated
22	Russia	300 Metalplating industries in St. Petersburg	MISSING DATA (cost est. 203 MEUR)
43	Latvia	VEF plant (electronic appliances)	YES ? (No data on investments)
44	Latvia	RER plant (electronic appliances)	YES ? (No data on investments)
92	Poland	Boleslaw in Bukowno (Metal smelter)	YES ? (No data on investments)

There are seven industrial hot spots that can be classified as metal industry in this report, even if they have different production. There are also other metal industry hot spots included in the JCP, but they are reviewed under the combined municipal and industrial element.

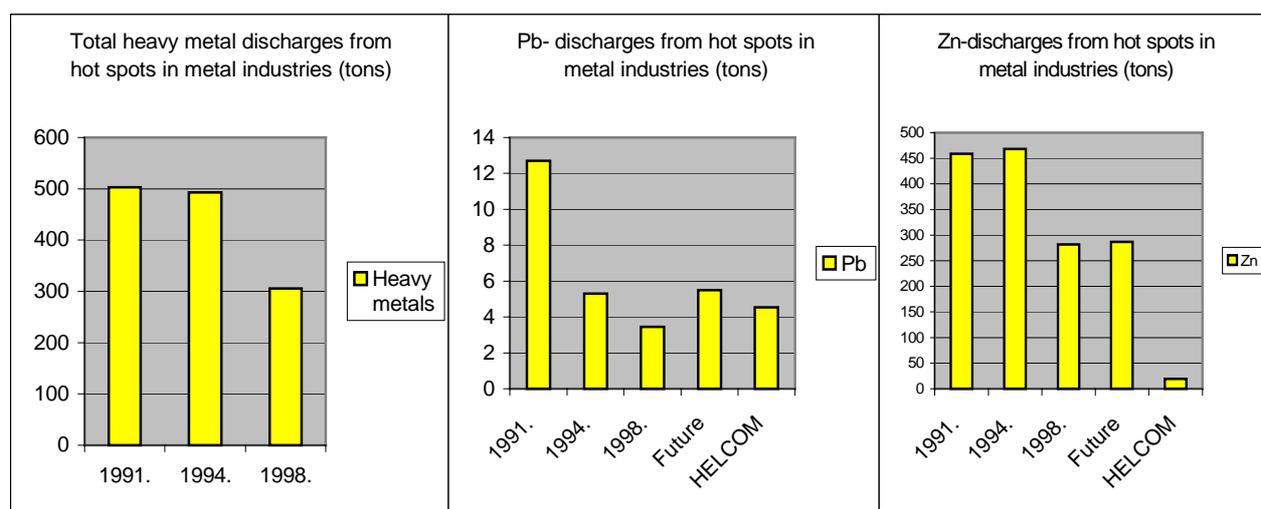


Figure 5.4. Discharges of heavy metals (tot), lead and zinc (in tons) from various metal industries compared with requirements of HELCOM recommendations (16/6 & 20E/6) in 1998.

The total amount of discharged heavy metals was reduced considerably between 1991-1998 (figure 5.4). This is mainly due to the environmental projects that were implemented in the plants, but also due to a reduction of production in the transition countries. A growth in the estimated future discharges and emissions is due to the planned increase in the production at hot spots 1 and 7. Their discharges will, however, be reduced in relation to their production volume.

However, discharges of heavy metals exceed in many cases the recommended levels of relevant HELCOM recommendations. It has to be noted that HELCOM has not adopted any specific recommendation for metal industry but the requirements on concentrations of metal discharges of other recommendations are however applicable, e.g. limit values of metals in the recommendation for chemical industry (20E/6). It has to be noticed, that the figures presented might give too positive a picture as they are calculated on the basis of reported waste water flow and quantity of pollutants. The waste water flow is sometimes reported without differentiation into process and cooling waters and the requirements of relevant HELCOM recommendations apply to concentrations in process waste water only. The calculated concentrations are hence lower than in reality for an industrial plant, if calculated on the total reported waste water flow even if it contains cooling waters. The reported data on discharges for the year 1998 may also be missing in some cases and in those cases data from 1994 is used.

In the two plants in Sweden and Finland the investments of 49,4 MEUR were allocated or already made. Rönnskärksverket is expected to comply with requirements in HELCOM recommendations after completing the ongoing project (45 MEUR allocated). 1,6 of 2,8 MEUR has been allocated on projects in the Volkhov plant. There is no data on investments in other plants.

### 5.3 Chemical industry

Hot Spot No.	Priority	Country	Name	Environmental investment activity
8		Finland	Kemira OY Vuorikemia (chemical)	DELETED -98 (21 MEUR inv.)
39	X	Latvia	Olainfarm (pharmaceutical)	YES ? (cost estim. 19 MEUR)
79		Poland	Bydgoszcz "Kapusciska" (chemical)	YES, 6,7 of 45 MEUR allocated
89		Poland	"Organika-Azot" in Jaworzno (chemical)	YES, 0,6 of 0,82 MEUR allocated
90		Poland	"Boruta" in Zgierz (dye stuffs)	YES, 16,8 of 18 MEUR allocated
91		Poland	Oswiecim – "Dwory" (chemical)	NO, lack of funds (5.03 MEUR)

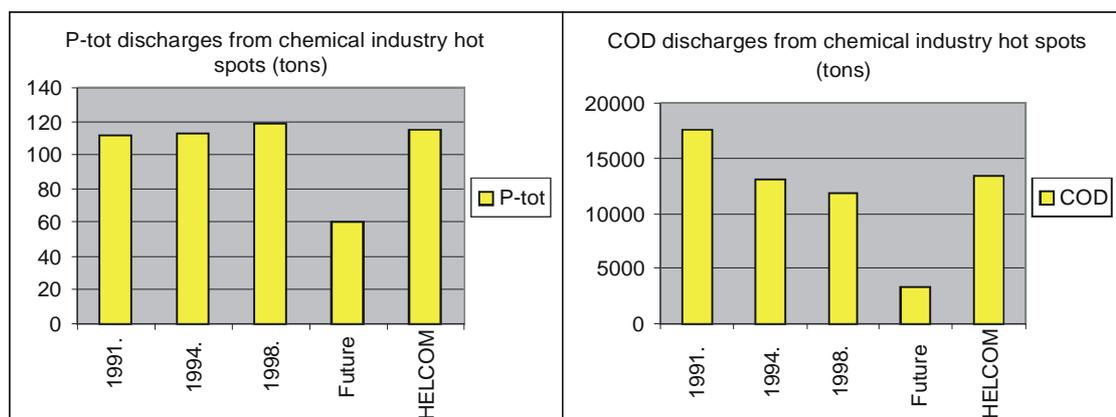


Figure 5.5. Discharges of COD and P<sub>tot</sub> from chemical industries compared to relevant HELCOM-discharges (20E/6). (These figures may look too good for chemical industry for at least two reasons. 1) Some of the cooling waters may be missing from calculations, and real compliance with HELCOM recommendations cannot be estimated (probably HELCOM requirements are not met). 2) Also parameters for the selection as a hot spot are not always the same as in figure 5.5).

The development of the waste water discharges has been varying. The discharges of metals and COD were reduced considerably (33-61%), but the discharges on  $N_{tot}$ ,  $P_{tot}$  and  $BOD_5$  have stayed at about the same level. Most of the reduction in pollution is due to the reduced production at hot spot no. 91. Hot spot no. 79 is responsible for the major part of the waste water discharges but will however be reduced considerably after the completion of the ongoing environmental project. The reduction of heavy metal discharges is mainly due to the construction of a waste water treatment plant at the deleted Finnish hot spot No. 8, which has reduced most of its metal discharges more than 99 %. Because of lacking data the comparison of compliance with HELCOM requirements can be shown only for COD and  $P_{tot}$ .

A total amount of 45 MEUR out of the estimated need of 109 MEUR to meet HELCOM JCP criteria were allocated on environmental projects between 1991-1998.

### 5.4 Fertiliser industry

Hot Spot No.	Country	Name	Environmental investment activity
52	Lithuania	Jonava Azotas fertiliser plant	YES (cost est. 35 MEUR)
54	Lithuania	Kadainai fertiliser plant	NO INFO
98/1	Poland	“Police” Chemical plant	YES
105	Poland	“Ubocz” fertiliser plant	NO, lack of funds (0,8 MEUR)
106	Poland	Boleslawiec - “Wizow” fertiliser plant	YES, 0,01 of 0,8 MEUR invested

There are five industrial plants that can be classified as fertiliser industries. One of them is a fertiliser industry plant included in a clustered, various industry hot spot.

The waste water flow from the fertiliser plants was reduced by 77 % and the discharges of  $P_{tot}$  by 92 % between 1991-1998, which indicates a considerable reduction in production since no major investments were made. Only 0,01 MEUR of the needed 36,6 MEUR was invested during this time period. It is not possible to compare the discharges with requirements of HELCOM recommendations since the production volume is not reported.

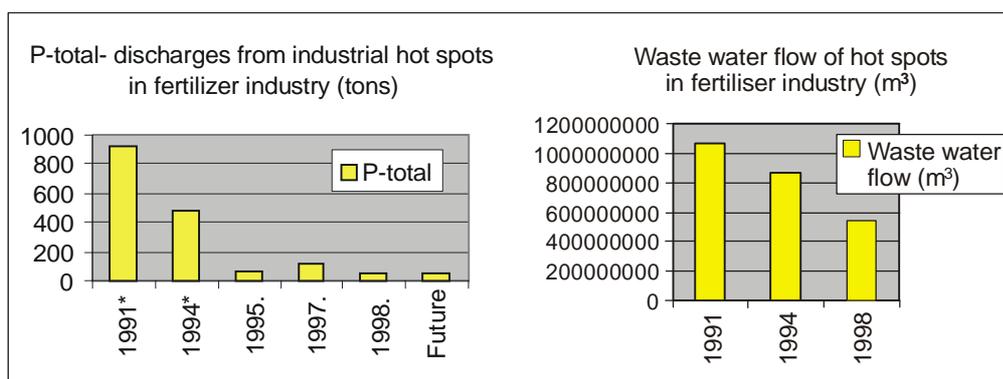


Figure 5.6. Discharges of  $P_{tot}$  and waste water flow ( $m^3$ ) from the fertiliser industry (tons)  
 \*Data is from hot spot review (1994) if available.

## 5.5 Mining industry

Hot Spot No.	Priority	Country	Name	Environmental investment activity
96		Poland	Upper Vistula River basin (salt control)	MISSING DATA
III		CS/Poland	Upper Odra River basin (salt control)	MISSING DATA

There are two hard coal and sulphur mining industries producing contaminated water among the hot spots. Due to lacking data it is not possible to estimate their development. Their environmental effect is significant for the state of Vistula river basin and the Oder/Odra river basin. In 1995 they released 1 450 000 tons of chlorides and 84 000 tons of sulphites. There is no data on investments in the area.

## 5.6 Food processing industry

Hot Spot No.	Country	Name	Environmental investment activity
35	Estonia	Vohma meat combine	DELETED -97 (closed)
56	Lithuania	Panevezys food processing industry	NO (cost estimate 0.17 MEUR)
102/2	Poland	Poultry processing plant in Prochowice	NO (lack of funds)

There are three food processing industries among the industrial hot spots. One of them was closed and the other has reduced its production considerably, waste water flow was reduced by 97 % between 1991-1998. The plant was far from compliance of requirements in HELCOM recommendations in 1995 (Recommendation 17/10). For example a reduction of 98 % in BOD<sub>5</sub> would be needed. No investments in the plant were made. The third food processing plant is in Poland, but due to lack of funds it has not made any investments.

## 5.7 Oil industry

Hot Spot No.	Country	Name	Environmental investment activity
62	Lithuania	Mazeikiai oil refinery and marine terminal	NO
71	Russia	Kaliningrad Oil Bunkering Station	NO, lack of funds

There are two industrial hot spots in oil industry. There have not been any investments made in this industrial sector. The discharges of oil were reduced from 3,8 tons to 2,5 tons between 1991-1995, but there is no more recent data on oil discharges. Mazeikiai oil refinery has increased its SO<sub>x</sub>-emissions considerably between 1991-1998.

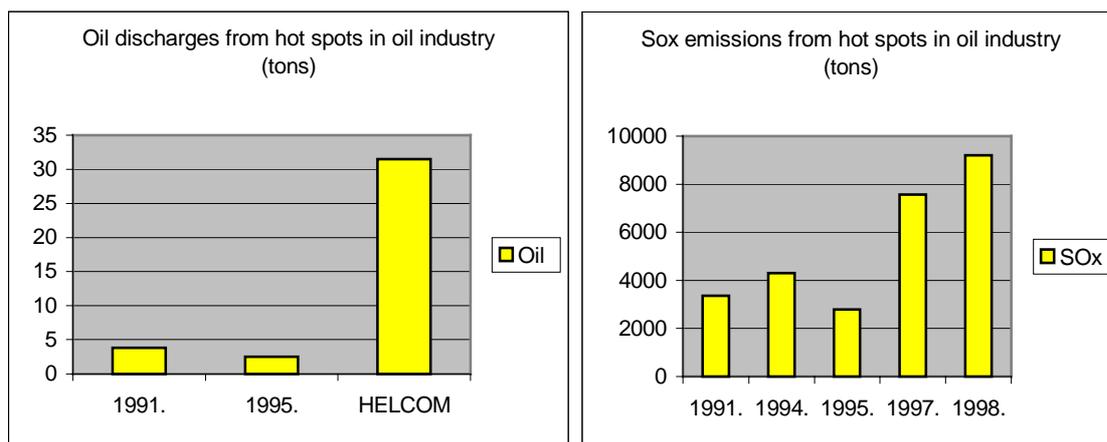


Figure 5.7. Emissions of  $SO_x$  to the air and waste water discharges of oil at oil refineries. (HELCOM recommendations 6/2).

## 5.8 Power plants

Hot Spot No.	Priority	Country	Name	Environmental investment activity
25	X	Estonia	Narva oil shale power plant	YES (cost estimate 225.3 MEUR)

There is one energy producing hot spot in Estonia which includes two oil shale power plants. The plants in Narva produce the major part of the energy in Estonia and the plants have substantial emissions of  $SO_x$ ,  $NO_x$  and dust into the air. Some minor investments have been made at the plants but the possible privatisation of the plants remains unclear. Due to the reduced production also the emissions were reduced. The  $SO_2$  emissions were still 4 times higher and the  $NO_x$  emissions 3 times higher than the requirements laid down in the EU directive 88/609/EEC for new power plants. The new proposed directive will be even more stringent.

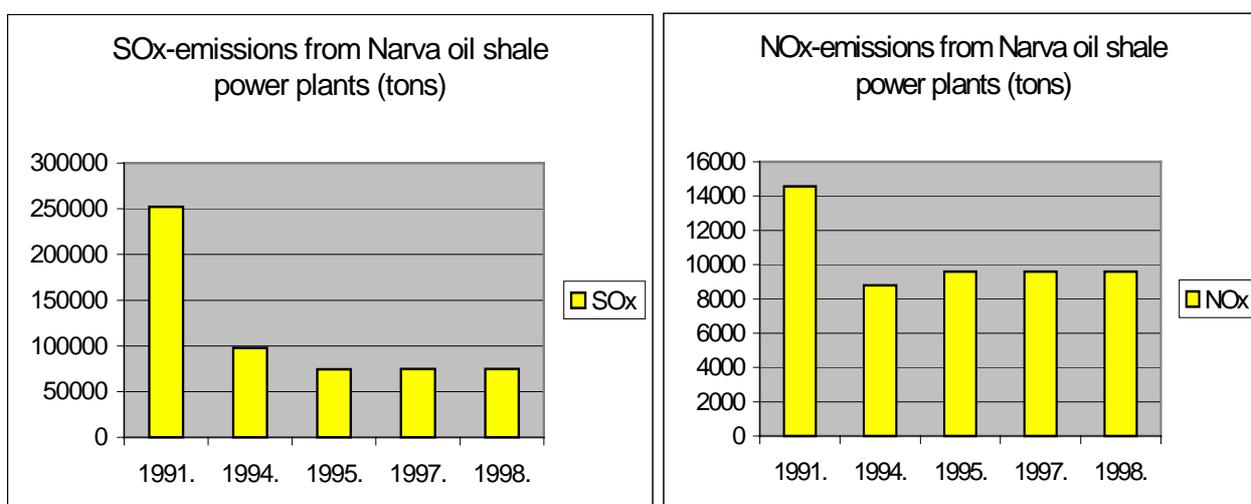


Figure 5.8. Emissions of  $SO_x$  and  $NO_x$  to the air from Narva oil shale power plants.

## 5.9 Various industries

Hot Spot No	Priority	Country	Name	Environmental investment activity
45		Latvia	Various industries	NO INFO
98	X	Poland	Szczecin (Fertiliser, p&p)	YES, 0,02 of 2,1 MEUR allocated
102	X	Poland	Legnica-Glogow (Fertiliser)	NO, lack of funds (cost est. 108 MEUR)
104		Poland	Wroclaw Chemical, food, textile	NO INFO (cost estimate 19,6 MEUR)
108	X	Poland	Katowice-West	NO INFO (cost estimate 8,8 MEUR)
110	X	Czech	Ostrava area	NO INFO (cost estimate 35 MEUR)

There are six hot spots which include various industries. These hot spots are responsible for a considerable portion of the discharges from industrial hot spots. There has been a problem in receiving data from these areas, since not all of the sub-hot spots have been clearly defined. The most comprehensive data is from the pre-feasibility studies from years 1991 and 1994. Poland has reported the discharges and emissions of some of the industrial plants mentioned in preliminary studies. It would be essential to define clearly the sub-hot spots of areas with various industries. It is obvious from the received data that some reduction has been achieved, mainly by reduced production, but also by the implementation of pollution control measures (See figure 5.9).

Investments of only 0,02 MEUR out of 173 MEUR needed to meet HELCOM JCP criteria have been reported in these areas.

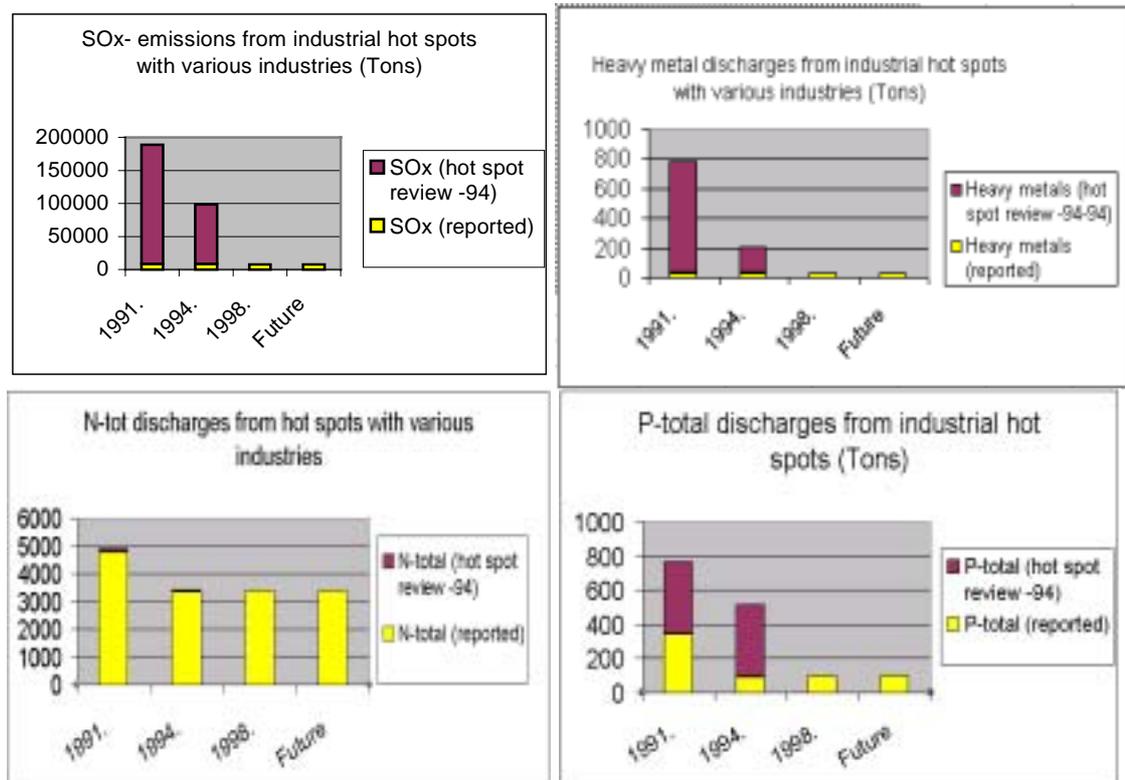


Figure 5.9. Discharges of SO<sub>x</sub>, heavy metals and Nutrients of hot spots with various industries (tons).

## Conclusions

### 6.1 Progress at industrial hot spots

#### General

The focus of infrastructure investments in the Joint Comprehensive Action Programme JCP has been on large municipal and industrial facilities, because they have a major impact on the Baltic sea. It was already recognised, when JCP was issued in 1992, that the various elements of the JCP would be implemented under differing schedules. In this context it was anticipated that measures to address municipal waste waters and the pulp and paper industries in Sweden and Finland would proceed rapidly. On the other hand progress in implementing measures required for industries in countries in transition would be closely related to the economic restructuring, privatisation and modernisation. The real progress at the hot spots seem to have followed this anticipated scheme. Investments in the Nordic pulp and paper industry have proceeded rapidly and required measures have been implemented with domestic funding. The investments in countries in transition have been much slower, although some hot spots have been deleted due to closing of the plants. The reasons for stopping the production have usually been economic and technical.

It seems, based on different available sources, that more financial aid has been given to the industries outside the hot spot list than to the hot spots. This shows that it is easier to find local motivation to invest in small enterprises and relatively modern facilities than in the most difficult sites. This is also economically justified, especially in the Baltic countries, where markets for products from former Soviet production facilities are limited. In Poland the situation is different and domestic resources are obviously allocated also for environmental and health reasons in the heavy industry. Some support has been given to western enterprises establishing new production facilities in the environmental field (outside the hot spot list), e.g. the production of water chemicals in Tallinn and the bioenergy plant in Turi.

The national reports are not always easy to interpret, and a lot of data needed for the assessment of progress made and the need for further assistance at the hot spots is lacking. Especially the type, volume and status of local activities remain often unclear. Sometimes it is difficult to assess whether financing is secured or only planned. Locally set time schedules may also not be realistic. Foreign financial assistance is not always noted in the national reports which may reflect its minor role compared to the need. Based on the reports from the hot spots it is not possible to fully assess the status of compliance with requirements in relevant HELCOM recommendations. This is partially due to shortcomings in the hot spot questionnaires. Nevertheless, the reviews presented certainly give a good overview, as well as details complementing more intuitive judgements.

### **Deleted Hot spots**

To date, totally 14 industrial hot spots and two industrial sub-hot spots have been deleted from the list. Of these, five are Swedish and five Finnish pulp and paper mills and one is a chemical plant (hot spot number 8), which have been deleted since they have implemented the pollution prevention and control programmes aimed at. Two Estonian hot spots (1 pulp and paper mill and 1 food processing plant) and the pulp and paper mill in Kaliningrad have been removed from the list because they have closed down. Also two Polish industrial plants, which are included in hot spots covering several plants, have closed down.

### **Investment activities**

As regards the investment activities it may be concluded, that out of the 36 remaining industrial hot spots, there is data on investments from 26 plants. Major investments have been implemented at 7 of the hot spots. Five plants have invested between 10-50 % of the estimated investment need, and 6 plants have invested 0-10 % of the investment need. In addition 7 of the plants have conducted some prefeasibility studies and other environmental programmes to some degree, but have not yet made any investments on actual upgradings. Out of the 10 industrial hot spots with no reported investments, 5 are clustered hot spots with various industries and two are mining areas near the Czech and Polish borders.

### **Development of production volume**

Production was reduced significantly between 1991-1998 at several industrial hot spots in the countries in transition. The total waste water flow from all of the remaining hot spots was reduced by 50 %. At least 11 of the plants, which have reported their waste water flow in 1991 and 1998, have reduced their waste water flow by more than 75 %. This indicates a considerable reduction in production, since none of these 11 plants have invested more than 10 % of the estimated investment need. The waste water flow was moreover reduced by more than 50 % at three of the hot spots, of which one had made significant investments. The production has also reduced at some of the cluster hot spots with various industries (at least Riga) and at the oil shale power plants in Narva. It can be concluded that production has reduced significantly on at least 15 of the 36 present hot spots. On the other hand production has increased significantly in both deleted and remaining hot spots in Sweden and Finland.

### **Development of discharges and emissions**

The reduction of discharges and emissions at the original 50 hot spots has been substantial. The decrease in pollution load is for major part due to lower production in countries in transition as well as infrastructure improvements especially in the pulp and paper industry in the Nordic countries. In the case of AOX, the implemented process and pollution control measures have been the main reason. For all of the original 50 industrial hot spots the reduction of discharges between 1991-1998 has been in total as follows: BOD<sub>5</sub> 70 %, COD 54 %, N<sub>tot</sub> 58 %, P<sub>tot</sub> 52 %, AOX 83 % and heavy metals 62 %. Air emissions were reduced accordingly, SO<sub>x</sub> by 56 %, NO<sub>x</sub> by 46 %, dust by 58 % and heavy metals by 61 %. The reduction of COD has been even larger at the remaining hot spots in countries in transition (66 %), but the reduction of AOX has been more moderate compared to the pulp and paper industry in the Nordic countries (65 %).

## **6.2 General reasons hindering the implementation of recommended measures at industrial hot spots**

There are several factors impeding the pace of investments made in the industrial hot spots in countries in transition. The problems are usually related to the general development of the restructuring of the economy and privatisation. A workshop on point sources was held in Tallinn already in 1994, but the problems identified there still mainly prevail. The obstacles identified have been e.g.:

- 1) Lack of financial resources. There is a competition between different sectors (for instance health vs. air pollution control) for the same resources. Domestic resources are insufficient compared to the needs. This is partially due to the scarcity of resources in general.
- 2) Privatisation is progressing slowly, which makes it difficult to create and allocate responsibilities concerning the environment. This creates uncertain perspectives and uncertain viability in the future.
- 3) Weak commitment to environmental questions on all levels of society, mostly on local and regional level.
- 4) Limited experience of successful cases and insufficient know-how and faith in technical and economical possibilities.
- 5) Conservatism and poor public awareness and public participation in decision-making processes. The local motivation may also be diminished in case a major part of the pollution comes from upstream and, as in many cases, from foreign sources.
- 6) Donors do not focus enough on the PITF hot spots, and only some pilot projects have reached the implementation stage.
- 7) Active foreign consultants try to benefit from the resources for financial aid, which may lead to ineffective use of time and resources as well as overlapping and inadequate aid projects.
- 8) Uncertain perspectives in the future, uncertainty of ownership after slow privatisation. Investors are not willing to take over landfills, old wastewater treatment plants and other polluted sites.
- 9) In principle, local subsidies have not been given to private enterprises.

## **6.3 Proposed measures**

Although significant progress has been made at industrial hot spots, continued and substantial support will be required to reach the targets of the programme. The possibilities for HELCOM to accelerate pollution control measures at the industrial hot spots are however limited and the main task has been to highlight the most problematic plants and assess their progress. The initiative for finding financial support must come from the industries themselves. Financial matters are often sensitive for the companies and they can be reluctant to submit information and handle these matters with "outsiders" especially if they are in the course of negotiating with possible financiers/buyers. One area where HELCOM PITF might however strengthen its efforts is increased problem oriented focus, i.e. paying attention to specific "problematic" hot spots seeking possible financial solutions. A close cooperation should be established between HELCOM PITF (mainly the Programme coordinator) and the contact person in the country in question and the hot spot itself to put together an investment package consisting of possible international funding and the required local share. The prerequisite for this is a wide knowledge of different international financial instruments available for different activities (the Programme Coordinator and the lead country) and local knowledge inclu-

ding sufficient background information on the present situation at the hot spot in question. The application for support would naturally be made by the plant itself and the role of HELCOM would be to give information on financial instruments suitable for this specific activity.

**The issues which HELCOM and especially PITF should address are:**

**Strengthened reporting on hot spots.** Improved reporting is a prerequisite for the Lead Country to be able to assess progress made at the hot spots. There are several hot spots with no or scarce data reported since the reviews made by the consultant. Some modifications to the reporting format are also required to enable assessment of compliance with e.g. industrial HELCOM recommendations. One solution for better reporting could be to report every two years instead of annually. This would give more time to collect more accurate data. The regional Hot Spot workshops arranged during 2000-2001 have though provided good information on the actual situation at the hot spots and it is highly recommended to continue to arrange these workshops.

**Updating of environmental studies.** So far little activity has been reported in large industrial area hot spots. The information on these complex industrial hot spots mainly located in the Czech Republic, Russia and Poland is scarce, and updated studies should be carried out and efforts for priority action should be strengthened in these areas. Poland has conducted a study, which examines the situation in Polish hot spots against hot spot criteria. The Polish study also proposes an updating of the present Polish hot spot list. For hot spots in and the upper Neva River basin in the Russian Federation (and also for combined industrial and municipal hot spots in Belarus) the initial study had its shortcomings, and arrangements for a new evaluation could be done by PITF. A clear decision on which sub hot spots are included in the large area hot spots could be a way to facilitate investments and improved reporting of discharges for these hot spots. This would also focus attention on special problems within the large hot spots. At the moment the reporting does not cover all the industries identified originally within these areas.

**Other general solutions.** The workshop in Tallinn had some suggestions for solving the identified problems listed in the previous chapter. Progress has been recorded for several of these points even if there still is room for improvements:

- 1) Environmental audits should be included in the privatisation process in order to clarify liability questions related to pollution sites and the refurbishment and to assess the level of the price of the site or production plant accordingly.
- 2) Politicians on both local and national level should be reminded of the commitments related to the Helsinki Convention.
- 3) Public awareness should be improved and the programme element of Public Awareness and Environmental education should pay special attention to the hot spots.
- 4) Donors should concentrate more on hot spots. Market rules and competition rules should be followed during the tendering process.
- 5) Project management, enterprise management and operation training should be included in environmental investment projects.
- 6) Regional cooperation between riparian countries should be strengthened.
- 7) Prerequisites for financing should be improved. Financing should be developed by methods recommended by the working group on environmental project financing of EBRD and by the ECE working group of senior governmental officials "Environment for Europe".

## **Improved reporting on hot spots**

Some suggestions are made here to improve the reporting of industrial hot spots based on shortcomings noticed during the compilation of this report.

### **Discharges and emissions**

- 1) Better reporting as a whole should be strived at.
- 2) All relevant available data on waste water discharges and air emissions should be reported, (even data on pollution which was not the original reason for the selection for a hot spot ). This enables compilation of summarized pollution trends of different parameters and a better assessment of compliance with requirements laid down in HELCOM Recommendations.
- 3) Especially for hot spots with various industries the countries should in their reports differentiate information for the plants in the area.

### **Treatment of waste water discharges and air emissions**

- 4) the waste water treatment method should be reported (mechanical, biological, chemical)
- 5) the proportion of process waste waters and cooling waters (and if cooling waters are in contact with process waste waters)
- 6) control techniques of air emissions.

### **Production volume and type**

- 7) production volume and type should be reported to enable better assessment of reason for pollution load changes and compliance with requirements laid down in HELCOM Recommendations.

### **Investments**

- 8) planned and implemented investments on environmental projects should as a whole be reported more accurately. It is sometimes difficult to assess whether the financing is secured or planned
- 9) if no investments have been made, a more detailed description of the reasons for lack of funding should be given.

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# Documentation page

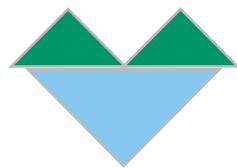
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Abstract	<p>The objective of this study is to present a comprehensive review of the environmental and economical progress at the industrial hot spots in the Baltic Sea catchment area during 1991-1998. Originally 50 industrial hot spots were identified by the The Baltic Sea Joint Comprehensive Environmental Action Programme (JCP) developed by a task force appointed by the Helsinki Commission (HELCOM). Finland has the responsibility to co-ordinate and assess the implementation of measures at the industrial hot spots.</p> <p>By the summer 2000, totally 14 industrial hot spots and two industrial sub- hot spots have been deleted from the list due to the implementation of the pollution prevention and control programs (11 plants) or because they have closed down (5 plants). Out of the 36 remaining industrial hot spots, there is data on investments at 26 plants. Out of 10 industrial hot spots with no reported investments, 5 are clustered hot spots with various industries and two are mining areas near the Czech and Polish borders. The total reduction of discharges and emissions at the original 50 hot spots has been substantial. For all of the original 50 industrial hot spots the reduction of discharges between 1991-1998 has been in total between 83 % (AOX) and 52 % (N<sub>tot</sub>). Air emissions have decreased accordingly. The decrease in pollution load is due to lower production at several plants and infrastructure improvements especially in the pulp and paper industry. The production has reduced significantly at 15 of the 36 present hot spots.</p> <p>Although significant progress has been made at industrial hot spots, continued and substantial support will be required to reach the targets of the programme.</p>	
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Tiivistelmä	<p>Tämän tutkimuksen tarkoituksena on esittää kattava yhteenveto Itämeren valuma-alueen hot spot -teollisuuslaitosten ympäristönsuojeluun ja investointeihin liittyvästä kehityksestä. Alun perin hot spot-kohteiksi valittiin Itämeren valuma-alueelta 50 merkittävästi ympäristöön vaikuttavaa teollisuuslaitosta, jotka nimettiin Itämeren suojelukomission (HELCOM) asettaman työryhmän valmistelemassa Itämeren suojeluohjelmassa (JCP). Suomella on vastuu koordinoida ja arvioida näiden teollisuuslaitosten ympäristönsuojeluun liittyviä toimenpiteitä.</p> <p>Kesään 2000 mennessä kaikkiaan 16 teollisuuslaitosta, joista kaksi sijaitsi useita teollisuuslaitoksia käsittävässä hot spot-kohteissa, oli poistettu hot spot-listalta. Laitokset oli poistettu listalta joko päästöjä vähentävien toimenpiteiden takia (11 laitosta) tai koska ne olivat lopettaneet toimintansa (5 laitosta). Jäljellä olevista 36:sta hot spot-kohteesta 26 oli raportoinut ympäristöinvestoinneista. Kymmenestä hot spot-kohteesta, jotka eivät olleet suorittaneet lainkaan investointeja, viisi oli monia teollisuuslaitoksia käsittäviä alueellisia hot spotteja ja kaksi kaivosalueita Tshekin ja Puolan rajan lähellä. Teollisuuslaitosten päästöt vähenivät selvästi aikavälillä 1991-1998. Tarkasteltaessa alkuperäisiä teollisuuden hot spot-kohteita ilmoitetut jätevesipäästöt vähenivät vähintään 52 % (<math>N_{tot}</math>), enimmillään jopa 83 % (AOX). Ilmapäästöt vähenivät samassa suhteessa. Päästöjen väheneminen johtui varsinkin Pohjoismaiden massa- ja paperiteollisuuden toteutuneista ympäristönsuojelutoimenpiteistä sekä monien muiden teollisuusalojen tuotannon vähenemisestä siirtymätalousmaissa. Tuotanto väheni merkittävästi 15:ssä nykyisistä 36 teollisuus-hot spoteista.</p> <p>Vaikka merkittävää kehitystä onkin tapahtunut, niin lisää toimenpiteitä tarvitaan, jotta Itämeren suojeluohjelman tavoitteet saavutettaisiin.</p>	
Asiasanat	Hot spot, HELCOM, jätevesipäästöt, päästöt ilmaan, investoinnit, teollisuus	
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Sammandrag	<p>Syftet med denna studie är att presentera en översyn över utvecklingen av miljöåtgärder och ekonomiska aspekter på sk. industriella hot spots i Östersjöområdet under åren 1991-1998. Sammanlagt 50 industriella hot spots identifierades ursprungligen av miljöprogrammet för Östersjön uppsatt av kommissionen för skyddet av Östersjön (HELCOM). Finland har ansvaret för koordinering och utvärdering av utvecklingen av utförda åtgärder på de industriella hot spotsen.</p> <p>År 2000 hade sammanlagt 14 industriella hot spots avskaffats från den ursprungliga listan pga utförda miljöåtgärder (11 installationer) eller för att de slutat sin verksamhet (5 installationer). Av de 36 kvarvarande hot spotsen finns det information från 26 installationer angående investeringar. Ansevära investeringar har gjorts på 7 hot spots. Av de 10 hot spotsen som inte rapporterat om investeringar är 5 stora industriella hot spots omfattande flera industrier och två är gruvindustriområden nära den Polsk-Tjeckiska gränsen. Reduktionen av utsläpp från de industriella hot spotsen har varit substantiell. Den totala minskningen av utsläppen från alla de ursprungliga 50 industriella hot spotsen har åren 1991-1998 varit mellan 83 % (AOX) och 52 % (N<sub>tot</sub>). Även luftutsläppen har minskat i samma grad. Minskningen av utsläppen beror både på den minskade produktionen på flera installationer och på de implementerade miljöåtgärderna speciellt på massa-och pappersbruken i de nordiska länderna. Produktionen har minskat avsevärt på 15 av de nuvarande 36 hot spotsen.</p> <p>Även om avsevärda framsteg har gjorts på de industriella hot spotsen, bör fortsatta åtgärder utföras för att nå de uppsatta målen i Östersjöprogrammet.</p>	
Nyckelord	Hot spot, HELCOM, utsläpp, industri, investering	
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