BALTIC SEA ENVIRONMENT PROCEEDINGS

No. 98

THEMATIC REPORT

STATUS OF THE HOT SPOTS IN SAINT-PETERSBURG AND THE LENINGRAD REGION

Based on
the Fifth HELCOM PITF Regional Workshop
St. Petersburg, Russia
June 2001

HELSINKI COMMISSION
Baltic Marine Environment Protection Commission

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FOREWORD

The main purpose of this Thematic Report is to present the current status of the Hot Spots located in Saint-Petersburg and the Leningrad Region.

The initiative relates directly to the HELCOM PITF Regional Workshops convened in the Baltic Sea countries, and is devoted to analyzing the implementation of the third element of the Baltic Sea Joint Comprehensive Environment Action program (JCP) - "Investment Activities Addressing Point and Non-Point Source Pollution". By the end of October 2002, one bilateral meeting and ten Regional Workshops had been conducted; the Regional Workshop in Saint-Petersburg, and materials presented and conclusions drawn at that Workshop are reflected in this Report.

The preparation of this Report has been based on Agreement No.03-31/1244 of 13.08.2003 between the Ministry of Natural Resources of the Russian Federation and the Saint-Petersburg Public Organization "Ecology and Business". The report reflects the situation in the region under study by the end of 2003.

The following bodies participated in the preparation of the Report:

- The Committee for Nature Use, Environmental Protection and Ecological Safety of the St. Petersburg City Administration;

- The Department of State Control and Perspective Development in the Sphere of Nature Use and Environmental Protection of the Ministry of Natural Resources of the Russian Federation;

- The Committee for the Agro-industrial Complex of the Leningrad Region of the Leningrad Region Administration;

- The State Unitary Enterprise "Vodokanal of Saint-Petersburg" of the St. Petersburg City Administration;

- The Saint-Petersburg Public Organization "Ecology and Business";

- The Saint-Petersburg Public Organization "Keep Saint-Petersburg Tidy".

Apart from the employees of the above-named bodies, the following experts from external organizations also contributed to the Report: Vladislav Minin (Hot Spot No. 24), Ludmila Terehova (Hot Spot No. 23), Tatyana Ivanova (Hot Spot No. 15), Igor Filimonov and Elena Scheglova (Hot Spot No. 14).

Saint-Petersburg
2004

INTRODUCTION

The Helsinki Convention has become the first international agreement governing all pollution sources both from the land and from the atmosphere. The Helsinki Commission (Baltic Marine Environment Protection Commission), also known as HELCOM, is the governing body for the Helsinki Convention. In order to restore the Baltic Sea to a sound ecological balance, the Baltic Sea Joint Comprehensive Environmental Action Programme (JCP) was approved and signed by ministers for the environment at the Baltic Marine Environment Protection Diplomatic Conference in Helsinki, Finland on 9 April 1992.

The main objective of the JCP is to support both "preventive" and "curative" measures in the Baltic drainage basin, aiming to reduce pollution loads and restoring the ecological balance of the Baltic Sea. Identifying and cleaning up pollution Hot Spots is an important part of this work.

The JCP has six main complementary elements:

- Policies, Laws and Regulations;
- Institutional Strengthening and Human Resource Development;
- Investment Activities Addressing Point and Non-point Source Pollution;
- Management Programmes for Coastal Lagoons and Wetlands;
- Applied Research;
- Public Awareness and Environmental Education.

At the establishment of the JCP in 1992 the costs of the Programme were estimated at18 billion ECU. In the countries in transition, where financing is a major constraint to investment, the use of co-financing that blends loans from the International Financial Institutions with grants from the European Union and bilateral donors, has proved to be a critical tool.

The HELCOM Programme Implementation Task Force (PITF) has been coordinating the implementation of the JCP as an autonomous body within the HELCOM framework. The PITF comprises representatives from the European Union and all the countries in the Baltic Sea drainage basin as well as International Financial Institutions and international governmental and non-governmental organizations.

On the initiative of the PITF, ten regional workshops and one bilateral meeting have been conducted involving all the countries participating in the JCP/PITF. The overall aim of the workshops was to present information and data on the Hot Spots as the basis for a detailed discussion of each Hot Spot under review with a view to removing the site from the List of Hot Spots.

Participants in the workshops included representatives from local, regional and national levels and so-called "Hot Spot owners". The workshops gave an overview of the environmental situation in general, the status of the Hot Spots in the countries and regions concerned, as well as information about the requirements and possibilities for accelerating the implementation of the JCP with a view to eventual elimination of Hot Spots.

The Fifth PITF Regional Workshop took place in St. Petersburg on 13-14 June 2001. The Workshop was opened by Mr. Dimitri Zimin, of the Ministry of Natural Resources of the Russian Federation, and welcomed by Mr. Alexey Frolov, from the Department of Natural Resources of the North-Western Region and Mr. Anatoliy Baev, representing the Department for Protection of the Environment of the St. Petersburg Administration. The Meeting was addressed by keynote speakers from the Russia/Saint-Petersburg and Leningrad Regions (Mr. Alexey Frolov) and also from the International Financial Institutions (Mr. Jaakko Henttonen, the European Bank for Reconstruction and Development, EBRD).

Mr. Alexey Frolov, of the Department of Natural Resources of the North-Western Region, described the environmental situation in the Region in the context of natural watercourses and lakes as well as in terms of the needs of the city of St. Petersburg. The most pressing problems centre on the water supply and municipal wastewater treatment, the emissions and discharges from industry (the Syassky Pulp and Paper Mil and Volkhov Aluminium) as well as hazardous waste disposal (the Krasny Bor Landfill). In general the environmental situation has been improving since 1992 but much still remains to be done. With the improvement of the Russian economy an accelerated implementation of the JCP and elimination of the Hot Spots in Saint-Petersburg and the Leningrad Region can be expected.

Mr. Jaakko Henttonen, as Principal Banker from the EBRD, representative of the IFIs and Vice-Chairman of HELCOM PITF, highlighted some of the main trends related to the Russian economy in general and to infrastructural investment needs in particular. The EBRD level of activity in Russia will increase to 1.0 billion Euros (about 30% of the annual commitment of the EBRD) in the few next years, illustrating a stable partnership with Russia.

The low level of investment in municipal infrastructure and industry is a reflection of the unsatisfactory status of the related regulatory framework. Reforms in certain sectors are urgently required to promote the principle of full cost-recovery as the economic basis for municipal enterprise. This should include realistic tariffs as well as the application of sound budgeting practices.

This Thematic Report on the status of Hot Sports in the Saint-Petersburg and the Leningrad Region has been prepared on the basis of material and conclusions resulting from the Fifth PITF Regional Workshop arranged in St. Petersburg and also on the basis of information submitted afterwards, and related to the latest state of the regional Hot Spots.

ASSESMENT OF HOT SPOTS LOCATED IN SAINT-PETERSBURG AND THE LENINGRAD REGION

The JCP lists nine sites as Hot Spots in St. Petersburg and the Leningrad region.

Table 1. The list of Hot Spots in St. Petersburg and the Leningrad region

Number	Site Name	Description
14	Syasstroi, the Leningrad Region (Syassky Pulp and Paper Mill)	Wastewater treatment, air pollution
15	Volkhov, the Leningrad Region (Volkhov Aluminium Mill)	Wastewater treatment, air pollution
18	St. Petersburg	Construction of new sewers, connection of direct outlets
19	St. Petersburg	Treatment of municipal and industrial wastewater
20	St. Petersburg suburbs	Treatment of municipal and industrial wastewater
21	St. Petersburg	Phosphorus removal from wastewater
22	St. Petersburg	Metal plating industry (heavy metals in wastewater)
23	St. Petersburg	Hazardous waste management
24	The Leningrad region	Treatment of wastewater and animal farm sludge

By site type the nine Hot Spots belong to:

- Municipal and industrial wastewater treatment and sewerage systems (Nos. 18, 19, 20, 21)
- Industry (Nos. 14, 15, 22)
- Hazardous waste (No. 23), and
- Agriculture (No. 24).

The results of a comprehensive analysis of Hot Spots made by national experts are presented in the following report.

MUNICIPAL HOT SPOTS

Hot Spot No. 18
Construction of new sewers and connection of direct outlets in St. Petersburg

Description of the Hot Spot (1992)

In 1992 the length of sewer pipeline in Saint-Petersburg totalled 6,878 km. The number of direct outlets of Vodokanal St. Petersburg was 213, which accounted for 646.7 million m^3/d of untreated wastewater discharges or 35 % of all wastewater discharges in St. Petersburg. The number of direct outlets from industrial enterprises was 330, representing 700,000 m^3/d of untreated wastewater discharges.

The tunnel sewage collectors leading to the North Aeration Station and the South West Aeration Station have not been built and there was no sewage collector on the Petrogradskaya side of the city. In addition to this, the feeder collector for the Central Aeration Station was in poor condition with1,200 km of sewage pipelines damaged. Furthermore, a combination of sludge deposits in the sewer pipes, a lack of advanced technology for the renovation and rehabilitation of sewage pipelines, the absence of efficient equipment for cleaning the sewage pipelines, and difficult hydrological conditions for laying sewage pipelines produced considerable problems.

The following circumstances hampered the connection of direct discharges sewers to the collectors in Saint-Petersburg:

- Because the direct discharges come from the old part of the city where traffic density is high, it is impossible to implement construction works for the laying of sewage pipelines without blocking the traffic.
- Narrow streets coupled with a high probability of damage to historical buildings during excavation works, create difficult working conditions in the old part of city.
- The hydrological conditions in St. Petersburg demand adaptations in the construction methods used for the sewerage network including the use of micro shield driving. Challenging soil conditions (such as small particle materials with high water content and instability) hamper the use of construction methods which require open trenches.
- The old equipment used in the sewage pump stations does not meet the requirements for operation in modern times.
- Low efficiency of pump equipment (45-50%).
- High power consumption rates of pumping equipment.
- Low-level automation of sewage pumping stations.

Measures implemented (1992-2002)

Renovation of sewage pipelines

In 1992 Vodokanal of St. Petersburg developed a Programme of renovation of sewage pipelines, which included:

- Study of the latest foreign technology and staff training at Vodokanal St. Petersburg;
- Implementation of pilot projects;
- Renovation of the sewage pipelines in the historical district of the city in collaboration with
- foreign companies.

The following organisations took part in implementation of the Programme during1992-93:

Vodokanal of St. Petersburg,
- Ministry of the Environment of Finland,
- Insituform Suomi OY (Finland).

Training seminars for specialists of Vodokanal St. Petersburg on the use of "no-dig" techniques for renovation of pipelines were held in St. Petersburg and Helsinki.

The following "no-dig" techniques have been imparted to the specialists of Vodokanal St. Petersburg:

- Breaking of the old pipe,
- Flexoren,
- Insituform,
- Channeline,
- Trolining.

The pilot projects involving the renovation of pipelines using "no-dig" technology were implemented in Liteiny Prospect and 9th Sovietskaya Street.

Advantages of the "no-dig" technique include:

- No need to excavate the roads.
- No need to block city traffic.
- Considerably shorter renovation period.
- Economical technique.

During 1995-1999 several international projects, which involved the renovation of sewer pipelines, were implemented by Vodokanal St. Petersburg:

- Survey and cleaning of the sewage pipes in Nevsky Prospect using video equipment.
- Rehabilitation of the sewage system under Nevsky Prospect.
- Renovation of the sewage pipelines in St. Petersburg.
- Renovation of the sewage pipelines in the historical district of St. Petersburg.

The following organisations were involved in implementation of the projects:

- Vodokanal of St. Petersburg,
- Ministry of the Environment of Finland,
- Danish Environmental Protection Agency,
- Viatek (Finland),
- Insituform (Finland),
- Per Aaslef (Denmark),

The results are that of a total of 189 km of sewage pipelines renovated during 1995-2002 in St. Petersburg, approximately 53 km was refurbished using "no-dig" technology.

Construction of tunnel sewage collectors during 1992-2003

In 2003 tunnel sewage collectors in St. Petersburg measured 197.61 km. At present the reserve collector leading to the Central Aeration Station and feeder collector for the South West WWTP are being constructed. It is expected that by 2008 the first line of the main collector (duker) will be in operation in the northern part of the city

The duker is a unique device that comprises two parallel sewage collectors laid deep underground (25 to 80 m). Each pipeline has an internal diameter of 3.3 m and a length of 12.2 km; the capacity is 600,000 m^3/d. Once this installation is commissioned for operation, it will allow the elimination of 145 direct wastewater outlets from Vodokanal St. Petersburg and also from industrial enterprises.

Renovation of sewage pump stations (SPS)

In 1997 Vodokanal of St. Petersburg implemented the project "Reconstruction of Standard SPS" with the assistance of the Ministry of the Environment of Finland and Sarlin (Finland).

30 sewage pump stations (SPS) were reconstructed by installing modern efficient equipment (70-80% efficiency) resulting in savings in capital and operating expenses and reduction of energy consumption. Automatic remote monitoring of SPS was also introduced.

Vodokanal St. Petersburg placed a high priority on automating the monitoring and sewerage management system within the framework of the project "Creation of a Control, Monitoring and Sewerage Management System in St. Petersburg". This undertaking was completed with the participation of Vodokanal St. Petersburg, the Ministry of the Environment of Finland and Viatek Ltd (Finland).

This project proceeded in five phases, and had the ultimate goal of addressing the following issues:
- To create an electronic map of sewerage pipelines and tunnel collectors with a scale of 1: 5000.
- To put into operation two automated central operator points in the Northern and Southern wastewater utilities.
- To provide remote access to the electronic sewerage system maps.
- To implement continuous automatic control of the hydraulic mode of the water discharge system.
- To develop a large-scale monitoring system for the operation of tunnel sewers, pump stations and WWTPs.
- To model real-time operation of the water discharge system.
- To optimize the operation of the WWTPs and pump stations in real-time.

This combination of measures has allowed Vodokanal St. Petersburg to get the latest information concerning the condition of the sewerage system and to take proper measures to prevent accidents.

Results

The length of the Saint-Petersburg sewer system increased by 635.98 km over the period 1992-2002 and reached 7,513.98 km in length by the beginning of 2003.

At the beginning of 2003, a total of 408 direct wastewater outlets discharging untreated wastewater into water bodies remained in the city; 172 of these were operated by Vodokanal St. Petersburg and 236 were managed by several industrial mills and organizations. According to data from Vodokanal St. Petersburg, 58 direct outlets were connected to the sewer collectors over the period 1991-2003.

The number of direct outlets connected to the sewer collectors between 1991 and 2003 is presented in table 2.

Table 2. The number of direct outlets connected to the sewer collectors

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Number	1	9	3	-	1	8	3	4	8	7	5	7	2

- 189 km of sewage pipelines has been renovated, 53 km by using "no-dig" techniques.
- Construction of the 14.4 km Petrogradsky tunnel collector has been completed; the cost of the project was Rubles 488 million. Completion of this project enabled the connection of 57 direct outlets carrying untreated wastewaters to the North Aeration Station.
- The main collector (duker) in the northern part of the city is being built.
- A reserve collector leading to the Central Aeration Station is under construction.
- 58 direct discharge outlets have been connected to the sewage system.
- An electronic map of the city sewage system has been made.
- Sensors for level measuring, which continuously send information to the operator service have been installed in the tunnel collectors.
- Automated central operator points have been set up at the Northern and Southern Waste Water Utilities.
- Sewage modelling systems are being implemented.
- Remote access to the electronic sewage systems has been established.
- Continuous automatic control of the hydraulic mode of the city sewage system has been implemented.
- 30 sewage pump stations have been renovated and new, more efficient equipment (70-80% efficiency) has been installed, resulting in savings in capital and operating expenses and a reduction in power consumption.
- Automatic remote control is being introduced at the SPS.

The annual volumes of untreated wastewaters discharged by direct outlets in 2002 are presented in table 3.

Table 3. The annual volumes of untreated wastewater discharged by direct outlets in 2002

Pollution loads (untreated waste waters, overflow and bypass), tons/y	Rizskaya Pump Station	Krasnoselskaya Aeration Station outlet 2	Municipal combined sewer outlets in St. Petersburg	Storm outlets in St. Petersburg
Overflow volume (mill. m^3/y)	44.962	19.3	126.29	52.41
Pollution loads (t/y)				
BOD total	3,453.7	5,109	12,728	3,609.5
Phosphorous total	81.75	85.15	421.27	54.71
Nitrogen total	609.65	546.9	2,608.9	535.8

Further actions

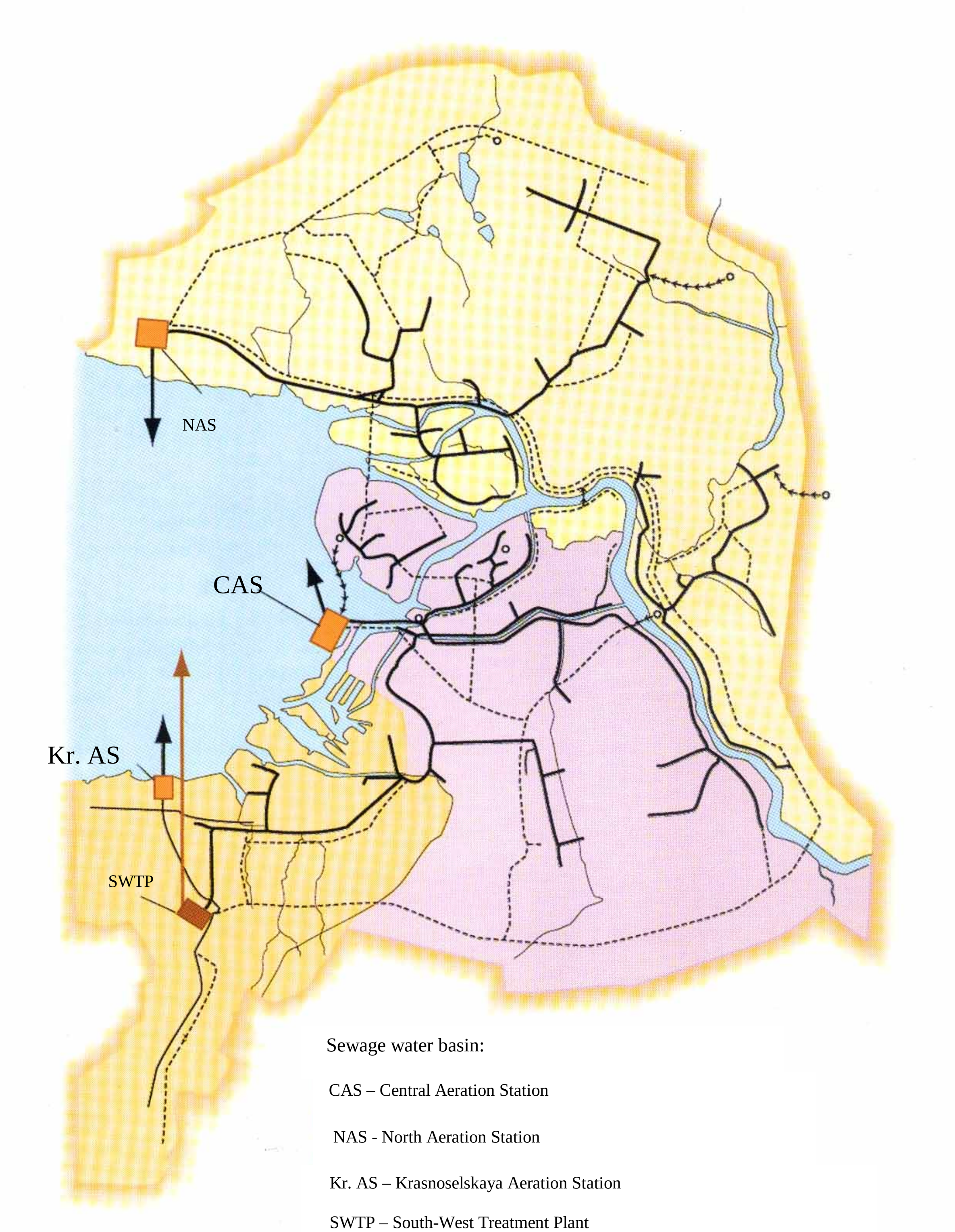
In 2000 specialists from Vodokanal St. Petersburg and the environmental protection authorities made an inventory of all enterprises with direct outlets of untreated wastewater. The institution "Lengyproinszproect" used the inventory results for the creation of a new programme for the elimination of untreated wastewater discharges into water bodies by 2015. The implementation of this programme will demand considerable investments of financial resources as well as manpower and machinery; however it is expected that it will result in the following:

- Completion of construction on the main collector (duker) in the northern part of the city.
- Connection of direct outlets to the municipal sewage network and full treatment of municipal and industrial wastewater, as well as storm and melted water treatment from combined sewers in Saint-Petersburg.
- Completion of construction on the reserve collector leading to the Central Aeration Station.
- Continuation of work to renovate sewage pipelines (40-50 km per year) and to ensure cleaning of the sewage pipelines with efficient equipment.

The programme to connect direct outlets to the Aeration Stations and provide biological treatment of wastewater is presented in table 4.

Table 4. Planned work content for the connection of direct outlets to the Aeration Station

Measures	**Units**	**Total**
Construction of sewage network for connection of direct outlets (taking into account discharges from industrial plants) and restoration of roads.	km	150.0
Tunnel collectors	km	28
Construction of additional Sewerage Pump Stations	m^3/s	8
Increase in the capacity of WWTPs	mill. m^3/day	0.374



_____________ Existing collectors

------------------ Collectors planned and under construction

Figure 1. General sewerage system of Saint-Petersburg

Hot Spot No. 19
Treatment of municipal and industrial wastewater in St. Petersburg

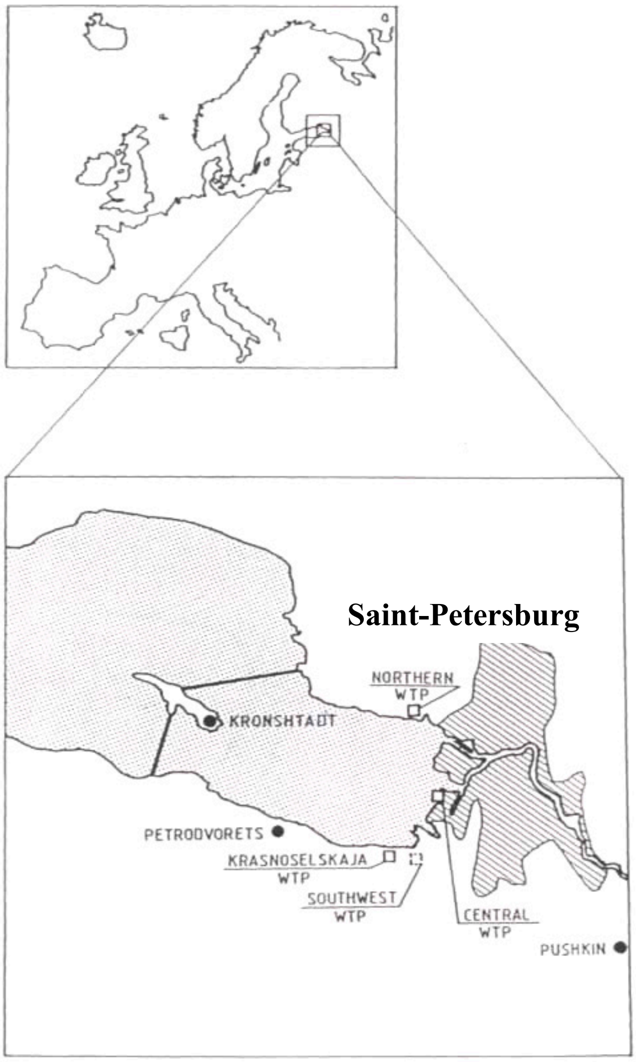


Figure 2. Scheme of the locations of Saint-Petersburg's WWTPs.

Description of the Hot Spot (1992)

In 1992 Saint-Petersburg had several Waste Water Treatment Plants in operation, two of which were the largest Aeration Stations in Europe. 873.3 million m^3 waste water was being treated annually, which represented an average of 65% of all discharges of polluted wastewater. The capacity of WWTPs in St. Petersburg in 1992 is presented in Table 5.

Table 5. Capacity of Waste Water Treatment Plants in St. Petersburg, 1992

St. Petersburg Waste Water Treatment Plants	Design capacity, thousand m^3/d	Actual load, thousand m^3/day
Central Aeration Station (CAS)	1,500.0	1,602.0
Northern Aeration Station (NAS)	600.0	602.2
Krasnoselskaya Aeration Station (KSAS)	70.0	140.0
Pargolovskie WWTP	0.17	0.17
Prigorodnye WWTP	0.7	0.7
Torfianoe	0.7	0.7
Zavodskie	0.3	0.3
Total	2,171.87	2,345.87

Problems

- Insufficient capacity of the municipal wastewater treatment facilities.
- Only 65% of wastewater in the city subject to comprehensive biological treatment.
- Deterioration of the technological equipment (corrosion of metal structures of primary and secondary settlers and aeration tanks).
- Low efficiency of wastewater treatment.
- Lack of technology for nutrient removal.
- Sludge treatment and disposal problems not solved.
- Insufficient area for sludge deposits.
- Absence of domestic production of flocculants for sludge dehydration.

Technological methods for wastewater treatment

- Mechanical treatment (grits, sand filters, primary settlers).
- Biological treatment (aeration tanks, secondary settlers).
- Concentration tanks.
- Sludge dehydration and disposal.

Sludge dumping

- High concentration of heavy metals in the sludge does not allow it to be used in agriculture.
- Wet sludge dehydrated on centrifuges and centripresses.
- Up to 1997 1,200 tons/day of dehydrated sludge was dumped (150 hectares of land in the suburb). The annual requirement was 8-10 hectares. Overall, 4.0 million tons of sludge has accumulated during 20 years of operation of the WWTPs.

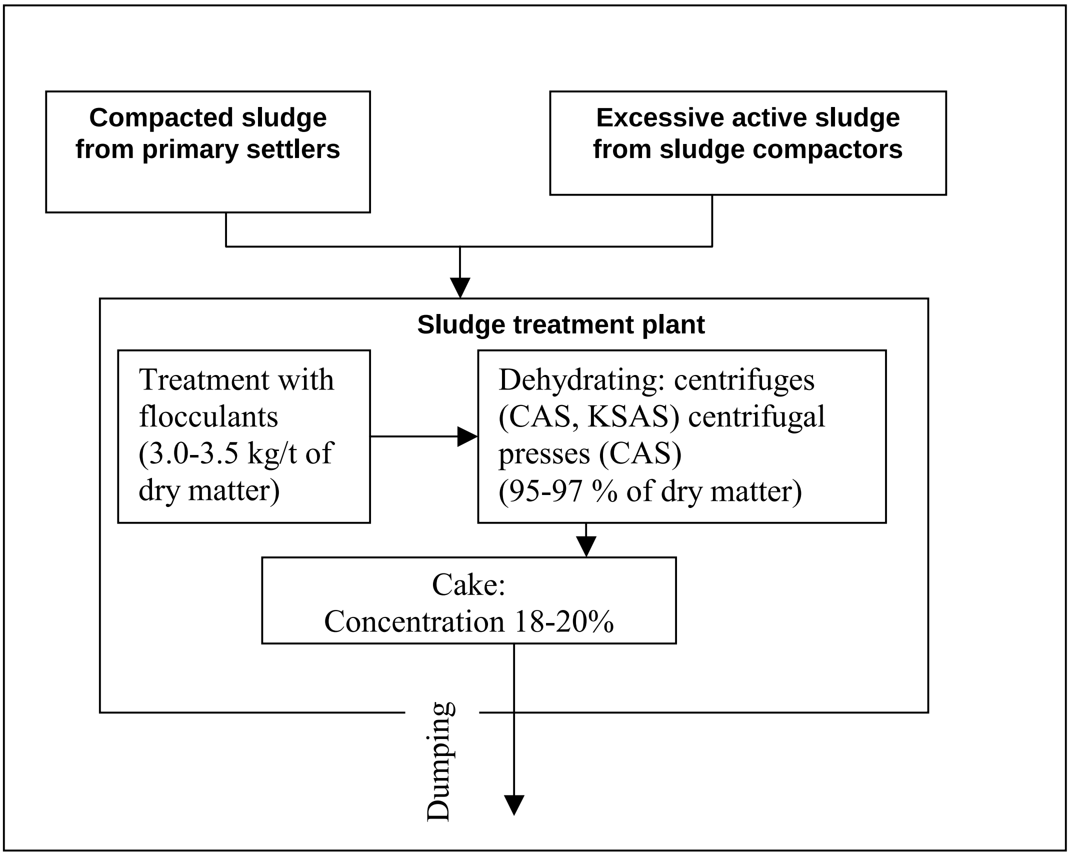


Figure 3. The technological method for sludge treatment at the Central Aeration Station, North Aeration Station and Krasnoselskaya Aeration Station

Measures implemented (1992-2002)

Central Aeration Station (CAS):

1. Restructuring of the aeration tanks system – replacement of steel perforated pipe with small bubble aeration system using glass fibre tubes for airflow distribution.
2. Restructuring of four secondary settlers – replacement of outdated sludge scraper with IS-54 spiral scraper, increasing sedimentation efficiency in the primary sedimentation tanks and deleting negative impact of lying up zones on the bottom of sedimentation tanks.
3. Modernization of sludge pumping station – replacement of outdated equipment with modern submerged pump.
4. Development and introduction of automatic monitoring and control of technological processes.
5. Setting up of production of domestically-developed gel flocculants "Percol +" for sludge dehydration with a capacity of 340 t/year.
6. Construction of a landfill for dumping of dehydrated sludge.
7. Replacement of outdated technological equipment.
8. Commissioning of sludge incineration plant furnace with boiling bed of quartz sand. Gas-dust emissions are directed to an electric filter and boiler-utilizer for treatment and for heating of air. The resulting ashes are dumped on landfills for reclaiming or are used in the construction industry. Waste gases are treated by wet acid and alkaline washing in the columns, and are emitted via a flue funnel 45 m high. The quality of waste gases corresponds to international standards. Rinsing water returns to the WWTP.

At present dehydrated sludge of CAS is incinerated; this accounts for roughly 70 % of all wastewater sludge. The commissioning of the sludge incineration plant at the CAS decreased annual storage levels of sludge by 278,000 tons and reduced transportation costs by a factor of ten.

Table 6. Efficiency of CAS operation

Controlled parameter	Input mg/l	Output mg/l
Suspended Solids	140-150	10-12
BOD	200-230	10-11
Phosphorous total	3.5-4.2	1.2-1.5
Nitrogen total	24-26	9.4-11

North Aeration Station (NAS):

1. 1995: Commissioning of the 1st phase of the 3d complex, resulting in an increase in capacity to 1,250 m^3/d.
2. 1995-96: Reconstruction of aeration system – replacement with small bubble aeration.
3. 1995-96: Replacement of equipment for sludge dehydration.
4. 1999: Rearrangement of the 1st section of the aeration tank (Q = 100 thousand m^3/d) into a biological treatment line.
5. Construction of landfill for dumping of dehydrated sludge.

The efficiency of this operation is sufficiently high, and concentrations of heavy metals in wastewater during treatment have decreased by 40 %.

Table 7. Efficiency of NAS operation

Controlled parameter	Input mg/l	Output mg/l
Suspended Solids	330-350	10-12
BOD	250-300	9-10
Phosphorous total	7.0-7.6	1.2-1.4
Nitrogen total	32-36	11-12

Krasnoselskaya Aeration Station (KSAS):

1. 1995 – 1996: Reconstruction of aeration system – replacement with small bubble aeration.
2. 1995 – 1996: Replacement of sludge dehydration equipment.

South-West Waste Water Treatment Plant:

Despite the fact that St. Petersburg has the largest wastewater treatment facilities in Europe, only 75% of the municipal wastewater is treated. One of the major reasons for this phenomenon is the insufficient capacity of the facilities, particularly the unavailability of wastewater treatment facilities in the south-west part of the city. At present some of the wastewater from the south-west area goes to the Central Aeration Station, and consequently, the quantity of wastewater treated there is greater than the design capacity of the Central Aeration Station. Because of this, a portion of the wastewater is discharged without treatment via Rizhskaya sewerage pump into the mouth of the Neva river.

Construction of the plant (capacity 500,000 m^3 /day) began in 1986, however the project suffered the following drawbacks:

- The problem with nutrients removal was not solved;
- The problem with sludge treatment and disposal was not solved.

In the same year, construction was suspended due to lack of funding.

In 1999 the 2nd meeting of the Sub-Committee on Power, Nuclear Issues and Environment in Brussels confirmed the willingness of some West European countries to finance the project. Late in late 1999, according to a resolution of the TACIS Programme, Vodokanal St. Petersburg carried out a preliminary pre-investment project feasibility study. The result showed that the project could not be fully implemented with traditional financing instruments.

As a result of these findings, a support group called 'Nordic Initiative' was formed. It included the following creditors and donors:

- Nordic Investment Bank (NIB);
- European Bank for Reconstruction and Development (EBRD);
- Nordic Environment Finance Corporation (NEFCO);
- Ministry of the Environment of Finland (MoE);
- Swedish International Development Agency (SIDA);
- Danish Environmental Protection Agency (DEPA).

To monitor, manage and control the implementation of the construction project, a Coordination Board was formed. It comprised the St. Petersburg Administration; Vodokanal St. Petersburg; NIB; NEFCO; MoE; DEPA; SIDA; and TACIS.

The Nordic Investment Bank acted as the coordinator of the project, with Vodokanal St. Petersburg as the executive body. .

The construction of the South-West WWTP will be completed with the financial support of the donor countries (Sweden, Finland and Denmark), the European Community (TACIS Programme), and a credit granted by the Nordic Investment Bank. The total number of financial sources is 14.

The revised technical design of the South-West WWTP includes biological treatment with improved processes for removal of nutrients (nitrogen and phosphorus).

Upon primary thickening, excessive active sludge is dehydrated by centrifuges and incinerated in fluidized bed furnaces. The combustion products from the furnace are transferred to the steam boiler for thermal utilization and later to the turbine generator. The energy generated by incineration can be used for electric power generation and heating of the WWTP. The flue gases are cleaned by electric filters and 99.9% of the ash removed, after which they pass through Venturi scrubbers for acid washing; caustic soda washing (alkaline washing) of gases takes place during the third stage. This process guarantees a high efficiency rate for the removal of heavy metals from the sludge.
The process for sludge treatment will be fully automated.

Results

1. Up to 75 % increase in municipal wastewater treated
2. Repair and replacement of outdated equipment at aeration stations.
3. Modernisation of the aeration system.
4. Development and installation of stage grates for mechanical treatment of raw sludge.
5. Setting up of production of domestic “Percol+” flocculant with improved specifications for sludge dehydration. Advantages:
   - decrease in flocculant dosage by 18%,
   - decrease in flocculant price by 24%,
   - sludge composition stability,
   - complete automation of the flocculant solution feed.
6. Installation of centrifugal presses for sludge dehydration at the Central Aeration Station (CAS).
7. Design, testing and installation of new pumps for pumping of dehydrated sludge.
8. Automation of the process for conveying dehydrated sludge into incinerators.
9. Construction and commissioning of sludge incineration plant (CAS). Advantages:
   - disposal of 47 % of sludge generated by the municipal WWTPs,
   - 50-55 t/d of ash generated instead of 1,000 t of dehydrated sludge,
   - transportation of non-stabilised and non-disinfected sludge has been stopped,
   - no need to build new landfills,
   - operating costs of incineration of 1,000 m^3 of sludge are 1.9 times lower than dumping costs for the same amount of sludge,
   - 10 times fewer trucks are required for transportation of sludge to dumping sites,
   - 278,000 tons less dehydrated sludge is dumped annually,
   - 25,500 tons of ash from incineration can be used for production of building materials (sanitary assessment of ash and bricks performed and technical specifications developed),
   - three-stage treatment of waste gases complies with Russian and international standards.
10. Construction of the South-West WWTP is in progress.

The environmental management system of Vodokanal St. Petersburg was recognized as complying with the international standard ISO-14001. The environmental audit of Vodokanal St. Petersburg was conducted by the certified companies Sai Global and the Russian Register. The auditors made a selective check of 6 branches, as well as 7 departments and offices, and all divisions were highly rated. As a result, Vodokanal St. Petersburg is the first water utility in Russia to receive the ISO certification for its environmental management system.

Further actions

Vodokanal St. Petersburg hired experts from the European Bank for Reconstruction and Development (EBRD) to conduct technological and environmental audits of the company. The results of the audit proved that the development strategy of the St. Petersburg water sector was appropriate.

The long-term strategy for the development of the water sector is the result of the joint efforts of EBRD experts, Vodokanal St. Petersburg and foreign firms COWI (Denmark); GET (Germany); Plancenter (Finland); Severn Trent Water International (UK); SPACE International (France), and SWECO (Sweden). The long-term objective is to meet the HELCOM requirements for wastewater discharges before 2015.

Completion of construction of the South-West WWTP

The Project "Completion of Construction of the South-West WWTP" is currently the largest environmental project in Europe. The designed daily capacity of the facilities is 330,000 m^3, while the quality of the treated water will comply with Russian and international standards, and in particular, with HELCOM recommendations.

Commissioning of the South-West WWTP will help reduce the current discharges of 23,000 tons of BOD, 520 tons of total phosphorus, and 3,200 tons of total nitrogen into the Gulf of Finland. At the same time the discharges of other pollutants will decrease by 40-70% A 24 million Euro grant has been allocated by the EU to implement the project, in addition to 30 million Euro from the Nordic countries and various environmental funds.
The South-West WWTP will be commissioned for operation in 2005.

In order to achieve this goal, the following related tasks should be fulfilled:

- Completion of the feeding tunnel duct,
- Connection of the sewer pipeline to the feeding duct,
- Connection of the WWTP to the municipal infrastructure (water supply, power supply, heating, telephone lines, gas supply).

Hot Spot No. 20
Treatment of municipal and industrial wastewater in St. Petersburg suburbs

Description of the Hot Spot (1992)

Table 8. Design capacity and actual load of suburban wastewater treatment plants

WWTP	Design capacity	Actual load	Water body (recipient)
	Thousand m^3/d	Thousand m^3/d	
Kolpino	110	82.9	Izhora river
Pushkin	72	62	Slavyanka river
Petrodvorets	50	55.5	Neva mouth
Kronshtadt	33	35	Neva mouth
Sestroretsk	17	13.7	Gulf of Finland
Zelenogorsk	11	6	Gulf of Finland
Metallostroy	9.5	12.7	Neva river
Pontonny	20.8	9.5	Neva river
Repino (mechanical treatment)	16.7	6.7	Gulf of Finland
Pesochny (river) Pesochny (wood)	0.26 0.7	0.85	Chernaya river, Dranishnik spring

Problems

- Insufficient capacity of treatment facilities.
- Deterioration of equipment (corrosion of metal structures in the primary and secondary settlers and aeration tanks).
- No removal of nutrients.
- Lack of treatment and disposal of sludge.
- Insufficient space for depositing dehydrated sludge.
- Low wastewater treatment efficiency.
- Imperfect techniques for measuring pollutants in waste water.

Measures implemented (1992-2002)

Pushkin

1. Introduction of equipment for pumping of wastewater.
2. Hydrological calculation and improvements programme for the water supply in the town of Pushkin.

Participants in these two projects:

- Vodokanal of St. Petersburg,
- Ministry of the Environment of Finland.

3. Russian-Swedish-Finnish Project: “Systems for establishing Effluent Limits based on Best Available Technology in accordance with HELCOM Recommendations as a Basis for Improved Environmental Conditions”.

Participants in the project:

Russia:

- Department of State Control and Perspective Development in the Field of use of Nature and Environmental Protection of the Ministry of Natural Resources of the Russian Federation in the North-West Federal Okrug.
- Saint-Petersburg Administration.
- Government of the Leningradskaya oblast.
- The Baltic Special Marine Inspection of the Ministry of Natural Resources of the Russian Federation.
- Neva-Ladoga Water Basin Administration.
- North-West Authority for the Protection and Reproduction of Fish and Fisheries Regulation.
- State Sanitary Inspection of the Leningrad region.
- Vodokanal St. Petersburg.
- Environmental Safety Center, Russian Academy of Sciences.

Sweden:

- Swedish Environmental Protection Agency (SEPA).

Finland:

- Ministry of the Environment.

During the implementation of the Pushkin WWTP project, the reconstruction and modernization programme was based on the implementation of the best available technologies for achieving standards according to HELCOM Recommendations. The company received a temporary discharge, emission and waste disposal permit approved by the Russian environmental and sanitary bodies for the implementation period. In order to issue the temporary permit a presentation before the "Environmental Court of Sweden" took place, with a jury consisting of Russian experts.

During the period 1992-2002 the following actions were implemented at the Pushkin wastewater treatment plant:

- Comprehensive repair of grits, sand filters, primary and secondary radial settlers
- Thorough repair of the aeration system of 2 aeration tank sections
- Complete repair of 4 sludge dehydration centrifuges
- Repair of the SPS
- Reconstruction of 3 aeration tank sections and introduction of technology for removal of nitrogen and phosphorus.

Petrodvorets

Financed by the Danish Environmental Protection Agency (DEPA), Vodokanal St. Petersburg installed water metering equipment as well as electric equipment for optimizing municipal water supply and sewerage, and for improving the operation of the WWTP.

During 1992-2002 general repairs were made to the WWTP, including the following:

- Secondary radial settlers and aeration tanks
- Municipal pumping station
- Air pumping station and reagent facility
- Technical and economic assessment of reconstruction and expansion.

Kronshtadt

Over the period 1992-2002 overall repairs were made to the WWTP, including the following:

- Settlers, aeration tanks and aeration system
- Sludge dewatering centrifuge
- Sludge facilities, sludge scrapers
- Control system, automation devices and SPS control
- Grits replaced by the cascade models
- Shop for sludge dewatering modified.

Kolpino

- Repair of aeration tanks and replacement of aeration system (replacement of filter plates for pipe aerators).

With the financial support of the MoE of Finland, Vodokanal St. Petersburg effected the restructuring of Kolpino's eight sewerage pumping stations (SPS).

Sestroretsk

From 1992-2002 complete repairs were made to the WWTP, including the following:

- 2.5 km of the 900mm sewage outlet
- Two primary settlers
- Secondary settlers
- Sludge dehydration centrifuge
- Development of a project for expansion and modification of the treatment facilities. .

Pontonny

During 1992-2002 general repairs were made to the WWTP, including the following actions:

- Repair of aeration tanks and replacement of the aeration system (replacement of filter plates for pipe aerators).

Zelenogorsk

Over the period 1992-2002 overall repairs were made to the WWTP, including the following:

- Reception chamber, sand filters, aeration tanks, primary and secondary settlers
- SPS, followed by hydraulic isolation of the underground section.

Repino

For the period 1992-2002 complete repairs were made to the WWTP, including the following:

- Four sand filters and digesting clarifiers
- 1.1 km of the 520-600mm outlet to the Gulf of Finland
- Modernization of Penaty SPS
- Repair and hydraulic isolation of the underground section of the SPS
- Technical and economic assessment of modification of the treatment facilities introducing total biological treatment and removal of nitrogen and phosphorus.

Pesochny

During 1992-2002 comprehensive repairs were made to the WWTP, including the following:

- Repair of primary settlers, biofilters and replacement of filler;
- General repairs and hydraulic isolation of the underground section of the SPS.

Results

Petrodvorets

- Implementation of measures to reduce water consumption
- Introduction of control system
- Installation of flow analysers to indicate oxygen and suspended matter content
- Implementation of measures aimed to cut power consumption by 50%
- Restoration of the design capacity of the treatment facilities
- Improvement in the quality of treated water

Pushkin

- Optimisation of the water supply and sewerage system
- Renovation of sewage pipelines
- Elimination of leaks
- Implementation of a programme of reconstruction and modernization based on use of the Best Available Technologies (BAT) to comply with standards according to HELCOM Recommendations

The measures implemented prevented the need for additional investment for the extension of the capacity of the WWTPs and reduction of their actual loads.

Actual Hot Spot status (2003)

Table 9. Design capacity and actual load of the Suburban WWTPs (2002)

WWTP	**Design capacity**	**Actual load**
	thousand m^3/d	thousand m^3/d
Kolpino	110	71.7
Petrodvorets	50	53.89
Pushkin	72	56.8
Sestroretsk	17	13.9
Zelenogorsk	11	4.6
Kronshtadt	33	32
Metallostroy	9.5	10.9
Pontonny	20.8	4.3
Repino (mechanical treatment)	16.7	4.1
Pesochnoye 1	0.26	0.12
Pesochnoye 2	0.7	0.6

Table 10. Characteristics of treated wastewater (2002)

WWTP	Average annual concentrations (mg/l)			
	Suspended solids	**BOD$_{total}$**	**P $_{total}$**	**N $_{total}$**
Kolpino	13	4.9	2.1	11.0
Petrodvorets	9.5	5.3	1.6	12
Pushkin	8.8	4.8	2.0	13.5
Sestroretsk	5.0	5.4	1.2	15.0
Zelenogorsk	5.8	4.0	1.0	12.0
Kronshtadt	6.4	4.9	1.5	11.0
Metallostroy	15.0	21.0	2.9	23.0
Pontonny	7.7	5.5	1.3	13
Pesochnoye 1	17.0	16.0	1.7	4.4
Pesochnoye 2	26.0	27.0	4.4	32.0

Future actions

The total waste water discharge from St. Petersburg's suburban areas is 109,684 000 m^3/year, including:

- Discharge of treated wastewater: 92,565,060 m^3/year;
- Discharge of untreated wastewater through direct outlets: Lisy Nos 41,000 m^3/year, Lomonosov 1,623,000 m^3/year and Metallostroy 945,000 m^3/year.

The programme for elimination of the Hot Spot involves:

- Construction of new biological WWTPs in Repino and Lomonosov.
- Expansion and modernization of the WWTP in Petrodvorets.
- De-commissioning of the old-fashioned WWTP in Metallostroy and transfer of the waste water treatment responsibility to WWTP in Pontonny, and modernization the latter.
- Completion of the WWTP modernization in Pushkin with introduction of the process for nutrient removal.
- Modernization of the installations for sludge dewatering at WWTPs in Pushkin, Kronshtad and Kolpino.

Hot Spot No. 21
Phosphorus removal from wastewater in Saint-Petersburg

Description of the Hot Spot (1992)

The main problems included:

- Insufficient capacity of municipal wastewater treatment facilities.
- Only 65% of wastewater in the city is subject to complete biological treatment.
- Low efficiency of wastewater treatment.
- Lack of technology for removal of nutrients at the wastewater treatment facilities.

Table 11. Phosphorus concentrations and discharge from the waste water treatment plants (1992)

WWTP	Initial water (P_{tot} mg/l)	Treated water (P_{tot} mg/l)	Waste water amount (Million m^3/year)	Discharge P total (Tons)
CAS	10.7	2.1	586.6	1,231
NAS	6.0	4.4	220.4	969
Krasnoye Selo	22.0	14.1	25.9	365
Total:				2,565

CAS: Central Aeration Station; NAS: North Aeration Station

Measures implemented (1992-2002)

During 1993-94 the reconstruction of the aeration systems at city and suburban WWTPs was carried out (large bubble systems were replaced by medium and small bubble units).

During 1994-95 Vodokanal St. Petersburg repaired and replaced the equipment for sludge removal at the WWTP as well as the installation for sludge treatment by flocculant. Removal of sludge from the biological treatment facilities decreases the phosphorus discharge in treated wastewater.

In 1995, with financing from the Ministry of Environment of Finland, Vodokanal St. Petersburg built a pilot unit at the Krasnoye Selo WWTP with a capacity of 3,000 m^3/d. It was used to test various methods for high-efficiency nutrient removal from wastewater in the St. Petersburg conditions. Cape Town University technology was adopted as the most appropriate (aeration tanks with three sections: anaerobic, anoxic, and aerobic). The results of the tests led to the development of recommendations for the design, construction and operation of biological WWTPs. Guidelines were also developed for the implementation of the Cape Town University technology at the WWTPs in St. Petersburg and its suburbs.

This technology permits increased sorption of wastewater phosphorus by active sludge by up to 8%. Currently, this technology is used in one aeration tank unit at the Northern Aeration Station.

Data related to the discharge of total phosphorous from WWTPs in Saint-Petersburg and its suburbs and via direct outlets during the period 1994-2002 are presented in Table 12.

Table 12. Discharge of P_{total} from WWTPs in St. Petersburg and its suburbs and via direct outlets (1994-2002)

Year	St. Petersburg WWTP	Via direct outlets	Suburban WWTPs	Total discharge P_{total}
	P_{total} (ton)	P_{total} (ton)	P_{total} (ton)	P_{total} (ton)
1992	2,565.0			3433
1994	1,458.6	458.4	153.0	2,070
1995	1,157.0	456.0	184.0	1,797
1996	1,230.7	427.3	203.0	1,861
1997	1,137.4	358.6	178.0	1,674
1988	1,113.5	514.5	194.0	1,822
1999	1,053.7	674.5	194.9	1,923
2000	871.1	718.5	170.6	1,760
2001	965.3	660.6	166.7	1,792
2002	987.2	648.0	158.5	1,794

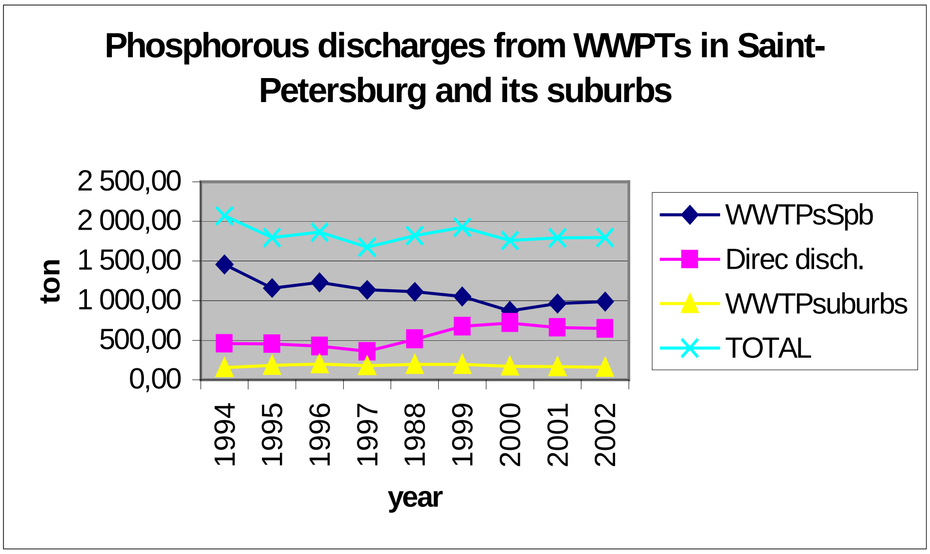


Figure 4. Discharge of P_{total} from WWTPs in St. Petersburg and its suburbs

Results (1992-2000)

- Decrease of phosphorus discharges in St. Petersburg wastewater by a factor of 1.9
    - 1992: 3,433 tons
    - 2002: 1,794 tons

- Decrease in Phosphorus discharges from the St. Petersburg Aeration Stations by a factor of approximately 2.5:
    - 1992: 2,565 tons
    - 2002: 987.2 tons

Table 13. Average annual concentration and discharge of P_{total} in treated wastewater from St. Petersburg and suburban WWTPs (2002)

	CAS	NAS	KSAS	Kolpino	Pushkin	Petrodvorets	Kronschtadt	Sestroretsk	Metallostroy	Pontonny	Repino	Zelenogorsk	Suburban	Torfyanoye	Pesochnaya (Lesnaya)	Zavodskiye	Pesochnaya (rechnaya)
mg/l *	1.48	0.86	**2.3**	1.49	1.5	**2.0**	**1.59**	1.5	**3.3**	1.1	**1.9**	**1.6**	**2.2**	0.76	**5.1**	0.69	**2.6**
ton	7456	181	60.3	34.1	32.8	40.0	16.6	7.9	15.4	2.0	2.6	2.7	0.7	0.2	1.2	0.09	0.16

* Concentrations which exceed requirements of the HELCOM Recommendation are indicated in bold fonts.

Table 14. Reduction in phosphorus content in treated wastewater

WWTP	P_{total} (mg/l)		Decrease (%)
	1992	2002	
CAS	2.1	1.48	29.5
NAS	4.4	0.86	80.4
KSAS	14.1	2.3	83.7

CAS: Central Aeration Station; NAS: North Aeration Station; KSAS: Krasnoselskaya Aeration Station

Table 14 shows the following reductions of phosphorus content in treated wastewater (1992-2002): CAS: 1.4 times, NAS: 5.1 times and KSAS 6.1 times.

In 1999 Vodokanal St. Petersburg addressed HELCOM via the State Committee of the Russian Federation for Environmental Protection, with a proposal to exclude Hot Spot No. 21 from the HELCOM Hot Spot list. The application was prepared and submitted for consideration by the First meeting of HELCOM LAND (3-6 April 2000, Helsinki, Finland). The meeting considered the application submitted by Russia and made the following resolution:

- The proposal does not completely correspond to the criteria for the exclusion of Hot Spots;
- The phosphorus load is still very high and 30% of wastewater is discharged into the Gulf of Finland untreated;
- The request to exclude the Hot Spot can be considered only after all proposed measures have been implemented and all municipal wastewater is subject to treatment.

Future actions

The issue of phasing out this Hot Spot is closely related to achieving the goals relating to sewerage and municipal wastewater treatment set for all Hot Spots in St. Petersburg. Vodokanal St. Petersburg has also set a large-scale long-term goal: to meet HELCOM standards for wastewater by 2015; an objective which will require the implementation of the following measures:

- Completion of construction on the South-West WWTP, ensuring efficient nutrient removal capabilities;
- Completion of construction on the main sewer duct in the northern part of the city to forward all wastewater from that district to the Northern Aeration Station thereby maintaining the design capacity load (1,250,000 m^3/d). This should result in reduced loads at the Central Aeration Station;

- Completion of work to connect all direct discharge outlets to the pipeline leading to the WWTPs and to treat almost all household and industrial wastewater, as well as storm and melting water collected from the common municipal sewerage system.

INDUSTRIAL HOT SPOTS

Hot Spot No. 22
Metal Plating Industry in St. Petersburg

Description of the Hot Spot (1992)

In the early 90s there were some 300 galvanic shops operated by industrial enterprises in St. Petersburg. Approximately 80% of their effluents was discharged into the municipal sewerage system and forwarded to the city treatment facilities. The remaining galvanic effluents were discharged directly into the rivers and canals of St. Petersburg.

Each year these enterprises generated a great deal of waste: 5,000 tons of solid wastes and 16,800 tons of liquid wastes, which were deposited at Krasny Bor, a hazardous wastes dump.

In 1992 the following quantities of heavy metals were discharged with wastewater in St. Petersburg: 68.7 tons of copper; 164.3 tons of zinc; 42.2 tons of nickel; 100.1 tons of chromium; 49.6 tons of lead; 8.66 tons of cadmium. At that time the St. Petersburg region was responsible for roughly 20% of the heavy metals pollution in the Baltic Sea.

Implemented projects, programmes and measures (1992-2002)

In 1994 the "Environmental Protection Programme for Machine Building and Instrument Production Industries for the Period 1995–2000" (hereinafter the '1995 Programme') was developed under contract with the Committee for Environmental Protection of St. Petersburg and the Leningrad region. The Programme estimates for the modernisation of basic production facilities were put at over $100 million (516 billion Rubles in 1994 prices). Neither the city, nor the enterprises concerned had such funds, and the 1995 Programme was consequently considered to be unachievable. Nevertheless, the city government had introduced several effective measures in order to implement the project economically whenever funds became available.

With financial support from the Ministry of Environment of Hamburg (Germany) in 1996, the International Projects Department (ECAT – St. Petersburg) of the Environmental Protection Authority hired Russian experts and restructured the water system at a small galvanic facility in Krasny Treugolnik. This project allowed the plant to satisfy Russian standards for heavy metals discharge. In addition to this, water consumption at the plant dropped 160 times following the reconstruction.

Having studied the results achieved at Krasny Treugolnik, experts from the Swedish Environmental Protection Agency and the Ministries of the Environment of Finland and Hamburg expressed their willingness to offer financial support and other assistance, and submitted a draft proposal entitled 'Reduction of Pollution in the Baltic Sea with Heavy Metals from St. Petersburg' to the European Union. This proposal was drafted by the Environmental Protection Authority and submitted in June 1996 by the St. Petersburg administration to the 'LIFE – Third Countries' programme of the Environment General Directorate of the European Commission.

As a result, the project was funded by EC (LIFETCY96/ROS/056) and was implemented between 01.01.1997 and 31.07.2000.The activities in the Programme included:

- Development and implementation of three demonstration projects to phase out heavy metals discharge at several St. Petersburg enterprises, as well as establishment and pilot operation of a mobile unit for collection and neutralisation of concentrated electrolytes.
- General assessment of environmental and economic impacts of the projects and a gradual reduction in heavy metals pollution of surface waters in St. Petersburg.
- Implementation of the programme's priority measures.

During project implementation it became clear that the basis for reduction of heavy metals discharge in St. Petersburg should be waste collection and treatment services for highly concentrated electrolytes. These electrolytes contained up to 80% of the heavy metals, and were discharged into sewers untreated. A mobile unit for the collection and neutralisation of liquid concentrated effluents was developed. During 1.5 years of operation it was shown that 14 enterprises in the city preferred to use its services rather than treating concentrated wastewater themselves and dumping toxic galvanic sludge.

Upon completion of the LIFE project, the following conclusions were drawn:

- Based on the experience gained during the implementation of the project and considering other foreign experiences, a document entitled "Recommendations on how to reduce Discharge of Heavy Metals from Galvanic Production Sites" was compiled and printed in 500 copies.
- The project yielded better results than planned, as demonstration projects were completed at four enterprises rather than three as previously planned.
- The annual discharges of heavy metals at three enterprises decreased as follows (in kg/year): aluminium – 125, iron – 125, zinc – 10, lead – 28, bismuth – 1, chromium – 1 800. Two galvanic plants reduced their water consumption and discharge by 95% and 99 %, respectively.
- New electrochemical equipment was introduced in one of the projects. This equipment permitted the reduction of heavy metal concentrations in discharges to targeted levels.
- The mobile unit for collection and processing of concentrated electrolytes was used by 14 industrial enterprises in the city and demonstrated the potential to cut heavy metals discharge by 80%. During pilot operation, the unit collected and processed 54.8 cubic meters of concentrated electrolytes including recovery of 1.9 tons of copper, 1.215 tons of nickel, 232 kg of lead and 150 kg of chromium.

Based on experience gained during the demonstration projects, proposals were developed for the "Programme of Stage-by-Stage Reduction of Heavy Metals Discharge in St. Petersburg". These proposals called for the first phase of the project to involve the collection of concentrated electrolytes, which were produced when old galvanic bath solutions were replaced. The Programme proposals showed that the discharge of heavy metals could be reduced by 80% at many installations, if collection and processing services were further developed and water consumption was minimised. This was especially true of the small plants and those works that did not have efficient treatment facilities. The proposals also contained recommendations on how to dispose of the hydroxides and metal oxides produced. The cost of the proposed solution was $2.3 million.

In 1997 Polygraphmash completed construction of a diversified effluent-free galvanic production demonstration facility with an annual capacity of 170,000 square metres. This project was implemented by German companies in collaboration with the plant specialists and with assistance from the German government. The plant requires only 20% of its galvanic capacity for its own production needs; however in 1999 the management was able to attract customers for its facilities, and increased utilisation rates to 80%, giving rise to the concept of modern galvanic centres.

The Finnish firm Galvatek made a detailed proposal for restructuring of the JSC Baltiysky Zavod treatment facility for galvanic wastewater. Having considered the proposal made by the Finnish experts, the plant management decided to invite submissions from Russian specialists and started reconstruction of the water system and galvanic wastewater treatment facility. Once completed, the approved design should reduce water consumption and discharge by 80%.

More than one hundred production sites have been shut down during the period under review, due to the economic crisis and reduction in production on the one hand, and on the other hand, the closure of old facilities with outdated equipment.

Some large industrial enterprises substituted production processes requiring hazardous substances with environmentally friendly technologies according to the guidelines of HELCOM Recommendation 23/7, entitled "Reduction of Discharges and Emissions from Metal Surface Treatment". Particular emphasis was placed on the following:

- Replacement of cadmium with zinc processes;
- Phasing-out of cyanides, mercury, EDTA, nonylphenol-ethoxylates, and chlorinated-organics;
- Replacement of electrolytes applied in cyanide zinc coating with the use of zincate;
- The use of alkaline solutions for degreasing.

The following measures have been introduced by the majority of galvanic plants in the city, to reduce wastewater and to minimize pollutants content:

- Introduction of multistage cascade rinsing of bath solutions;
- Recycling of plating bath solutions for reuse (ion exchange, electrolyses, thermal treatment);
- Implementation of measures to prevent leakages and overflows;
- Modernisation and reconstruction of local wastewater treatment facilities.

Results

- All large galvanic shops have local treatment facilities, which include neutralization and reagent treatment for depositing heavy metal salts. The resulting sludge is dumped at hazardous waste landfills.
- Galvanic plants are being reconstructed; cascade rinsing is being introduced at some facilities (1, 2 and 3 stage); and water recycling systems are also being introduced.
- Five galvanic shops have completely closed water cycles.
- Cadmium processes are replaced with zinc technologies.
- The EU-LIFE financed project "Reduction of Pollution of the Baltic Sea with Heavy Metals from St. Petersburg" was completed. It involved restructuring of water systems at four large galvanic facilities as well as collection and processing of used concentrated electrolytes by a special mobile unit. The mobile unit collected 54.8 cubic meters of concentrated electrolytes from 14 enterprises, including recovery of 1.9 tons of copper, 1,215 tons of nickel, 232 kg of lead and 150 kg of chromium.
- "The Programme of Stage-by-Stage Reduction of Heavy Metal Discharges in St. Petersburg" was drafted.
- There has been no record of violations of HELCOM's recommended levels for effluents discharged into water bodies.
- 80% of enterprises discharge wastewater into the municipal sewer system and comply with the HELCOM recommended values. Other enterprises violate recommended values in relation to individual parameters.
- Heavy metals in waste water were reduced in St. Petersburg in 2002 as follows: Cu – 87.4 %; Zn – 55.9 %; Ni – 79.6%; Cr – 94.8 %; Pb – 92.9% and Cd – 96.7%

Table 15. The amount of heavy metals (tons/year) discharged with wastewater in St. Petersburg (1992-2001)

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Cu	67.8	66.6	28.5	20.4	14.5	12.1	11.9	14.0	10.1	8.49
Zn	164.3	304.1	256	149	135	93.6	74.1	80.0	65.5	72.38
Ni	42.2	45.1	26.4	15.7	10.1	9.94	11.3	13.9	8.78	8.6
Cr	100.1	76.5	23.5	14.3	12.9	6.07	5.34	5.83	4.56	5.13
Pb	49.6	29.6	18.0	10.8	5.33	4.37	4.74	4.34	5.11	3.5
Cd	8.66	4.19	2.28	1.0	0.45	0.69	0.32	0.34	0.39	0.28

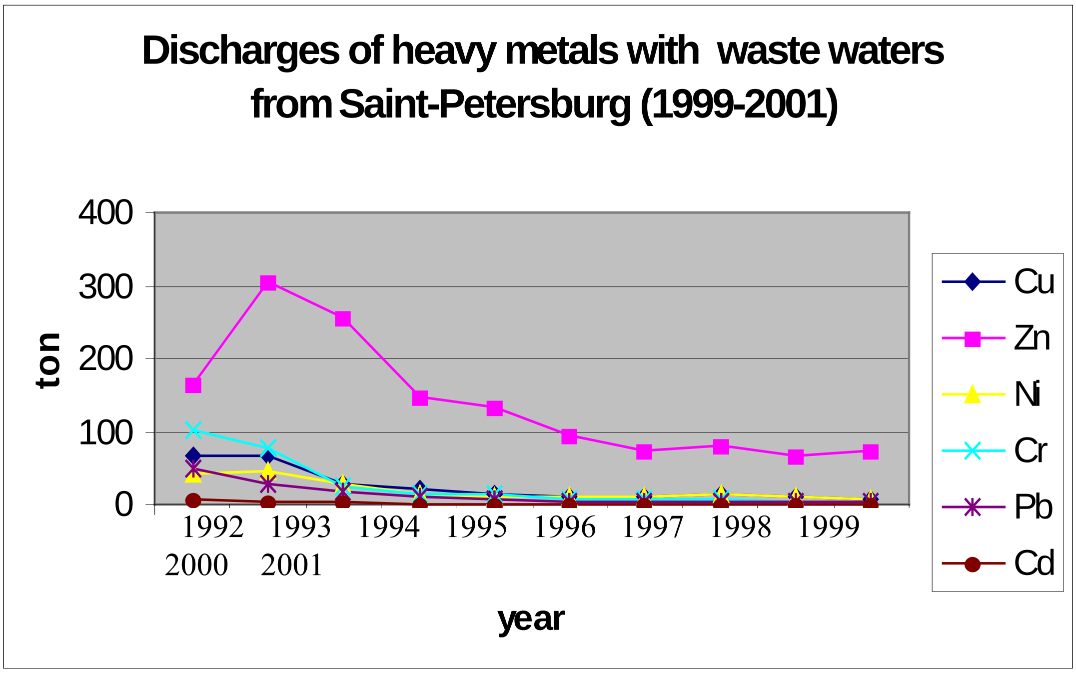


Figure 5. The amount of heavy metals (tons/year) discharged with wastewater in St. Petersburg (1992-2001)

Further actions

Measures involving further improvement of technological processes, and construction and modernization of local wastewater treatment plants are planned for some enterprises. Implementation of the planned actions is dependent on the financial resources of the enterprises.

Priority measures may be changed at a later stage, depending on the economic situation and the relative significance of some parameters for pollution discharges into natural water bodies. The major factors determining this should be environmental legislation, environmental assessments and audits of projects and companies.

In 2002 a new federal law on "environmental protection" was adopted in Russia. The new legislation aims to develop a modern national system of technology standards based on best available technologies (BAT). This system will result in a more efficient process for granting permits to industrial enterprises and will ultimately lead to better environmental protection. The law introduces a concept of technology standards based on allowable discharges and emissions of substances and microorganisms into the environment per unit of production (Clause 1). The technology standard stipulates the application of the Best Available Technologies (BAT) with regard to economic and social factors (Chapter 5 Environmental standards). Subordinate legislation for the implementation of the technology standards has not yet been developed. Russian standards on discharges and emissions, which are currently applied, are 10-100 times more stringent than those used in developed European countries.

The current system of environmental fines and penalties for discharges and emissions in Russia is beyond criticism and is not the right economic mechanism for promoting environmentally sound activities.

Economic methods should provide the way for new and modernized enterprises to apply waste-free, low water-consuming technologies for galvanic and alternative coating industries. The principle of "Best Available Technology" will be used for issuing permits and making reconstruction plans, and will also encourage enterprises to apply up-to-date environmental systems, such as ISO-14000, which will allow the manufacture of environmentally-certified products.

The draft of the Key Activities Plan of the St. Petersburg Administration related to environmental protection and environmental safety for 2003-2007, includes a section on the improvement of environmental management and environmental safety. This section implies that environmental management is among the priorities of the city management.

ISO 14001 and ISO 14004 standards will be applied when improving the environmental management of the St. Petersburg administration. These standards contain the requirements for the environmental policy of the territorial entity and for achieving goals based on the requirements of the environmental legislation and the results of environmental monitoring.

Positive results in this respect have been achieved. Despite approximately a 30% growth in production activity in St. Petersburg in recent years, industrial discharges have not increased, but on the contrary have been reduced.

Hot Spot No. 15
Volkhov Aluminium Plant (air pollution control and wastewater treatment) in the Leningrad Region

Description of the Hot Spot (1992)

The branch of JSC "Metalurg", Volkhov Aluminium is one of the largest industrial enterprises located in the town of Volkhov. The production facilities are located on the right bank of the Volkhov River, 120 km away from St. Petersburg, in the northern part of the town of Volkhov, and 20 km from the Ladoga Lake. The Volkhov River is the source of process water for the mill and also supports fisheries; in spite of this, wastewater is discharged into the river.

Production

In 1992 the production facilities were run by JSC “Volkhov Aluminium” which produced aluminium, alumina, soda and potassium carbonate, Portland cement, super phosphate, fluorine salts, sulphur acid, diammonium phosphate, and also generated heat power.

The technological processes involved were:

- Aluminium Production,
- Sulphur Acid Production,
- Polyphosphates Production,
- Sulphur Oxide Potassium Production,
- Agglomerated Phosphate Production,
- Fluxed phosphate production,
- Lime-magnesium iron flux production.

Wastewater treatment

The mill had three wastewater outlets, wastewater treatment facilities, clay and earth shop slag deposit, and gypsum storage facilities.

The collection of industrial and general wastewater involved three collectors (D=1,200 mm, 1,000 mm and 800 mm) and a wastewater duct. The composition of the waste water in each collector was particular: the waste water in the 1,200 mm and 1,000 mm collectors contained fluorine, phosphates, and sulphates; while waste water in the 800 mm collector contained aluminium and suspended matter, all with considerable deviations in concentration.

The water system in the mill featured eight recycling systems. The gypsum storage facility No. 2 was incorporated into the water recycling system and there was no direct discharge. After treatment in the settler, wastewater was discharged into the Volkhov River. Wastewater from the municipality and the mill was subject to biological treatment before being discharged via dispersing outlet into the receiving water.

Table 16. Discharge of hazardous matter in 1992 (discharge: 3,609,000 m^3/ year)

Pollutant	Concentration (mg/l)	Annual discharge (t/year)
Suspended matter	850.79	3,070.50
Dry residue	1,687.8	6,091.3
Petroleum products	2.16	7.8
Phosphates	183.57	662.5
Fluorine	21.57	77.8
Sulphates	441.5	1,593.4
Iron	0.45	1.62
Chlorides	144.3	520.8
General nitrogen	19.96	72.035

Gas cleaning

All the major production phases were equipped with gas cleaners – electric filters. The gas cleaning electric filters located in the post clinkering furnace position operated efficiently, with the maximum efficiency measured at 54%. The operation of the electric filter located in the post alumina calcination furnace position was not efficient. Built in 1947, this filter was worn and outdated. Gas cleaning facilities were renovated including construction of a new electric filter located in the post alumina calcination furnace position.

In the cement facilities, inefficient electric filter located post cement mills was replaced and a project to reconstruct gas treatment facilities located post clinker furnace was designed.

In the aluminium production process, gases from electrolysers were subject to two-phase cleaning in an electric filter and scrubber with built-in drop trap. Dust collected in this manner was re-introduced into the production process.

In the super phosphate production process gases from the extractor and carousel vacuum filter were cleaned with two absorbers and a drop trap located before the discharge in the funnel; dust in gases discharged from the operation was cleaned in cyclones and by wet cleaning.

Discharge of hazardous matter

Sanitary inspection at a permanent control point located in the habitation zone conducted 2,262 air tests, 80 of which revealed violations of maximum allowed limits:

- SO_2 - 32 (1.03 times maximum allowed concentration),
- HF - 24 (1.36 times maximum allowed concentration),
- NO_2 - 4 (1.03 times maximum allowed concentration),
- Dust - 10 (1.68 times maximum allowed concentration).

Table 17. Emission of hazardous matter in 1992

Pollutant	Emission t/year
Total	7,735.7
Including:	
Solids	2,855.8
Gases	4,879.9
Gases including:	
Fluorine	252.6
Sulphur anhydride	2,387.5
Carbon oxide	1,644.5

Problems and analysis of 1992 status

Water

1. Lack of wastewater treatment plants for industrial and storm water.
2. High possibility for failure of production equipment /outdated equipment in sulphuric acid production, unreliable operation of gypsum ducts in production of super phosphates.
3. Unstable production of super phosphate, failures in the alumina technology.

Air

1. Physical wear and outdated equipment used for gas cleaning in cement production and outdated electric filter located post alumina calcination furnaces
2. Absence of gas cleaning in alumina refining shop
3. Technological problems in super phosphate production, uneven operation of sulphur acid shop.

Remedial projects and programmes

1. Construction of rainwater treatment facilities.
2. Disposal of diammonium phosphate waste.
3. Reconstruction of the gas cleaning facilities in the cement mill post clinkering furnace and post cement mills.
4. Reconstruction of electric filter post alumina fluidized bed furnace.
5. Restructuring of super phosphate production under "FLUORINE" programme for excluding fluorine compounds emission in the gaseous phase of production.
6. Implementation of actions for reduction of aluminium and alkaline losses in discharge. Under contract with Kazmekhanobr Institute.
7. Reconstruction of sulphur acid production.
8. Construction of local wastewater treatment plants.
9. Reconstruction of gas treatment equipment located post furnaces in flux production.
10. Reconstruction of gas treatment of electrolyses production.

Programme Implementation (1992 - 2003)

1. The All-Russian Aluminium-Magnesium Institution developed a project for storm water treatment facilities. 30 % of the project has been implemented.
2. Research was conducted on the disposal of diammonium phosphate waste, and in 1994 diammonium production was closed.

3. A Post cement mills electric filter was built in the cement mill. 70% of the project was completed. A project for reconstruction of the wastewater treatment from clinkering furnaces was developed. In 1995 cement production was stopped and the plant was closed.
4. In 1995 alumina production was stopped.
5. Construction of phase III of wastewater treatment facilities has begun.
6. In 1994 the double super-phosphate production was closed.
7. The need for sulphuric acid has been greatly reduced. Of the technological systems that previously operated, only one system is functioning today. This system has been thoroughly repaired.
8. Inspection of electric filters located post flux furnaces was performed by the Institution "Proectgazoochistka".
9. The existing water system at the mill and the industrial and general wastewater system have been inspected.
10. The gas-treatment component of the electrolytes production system was inspected by the Institution "Proectgazoochistka" in 2002, and an expert evaluation of the technical condition of the two-stage gas cleaning process was presented.
11. Tests have been performed on the wastewater treatment facilities of the general wastewater outlet from the mill.
12. The water recycling system at the mill has been inspected and a recommendation presented for dehydration of the wastewater sludge from the water recycling system.
13. Flow meters for registration of wastewater in different shops have been installed.

All the outlined actions have been performed without outside resources or funding.

Actual Hot Spot status (2003)

"Volkhov Aluminium" produces raw aluminium, polyphosphates, sulphuric acid, fluxed phosphate, sulphur oxide potassium, soda, fluxes, sulphur oxide aluminium, and generates thermal energy.

The mill has one process wastewater discharge outlet, gypsum storage facilities (one working, while the other is used as a dump for waste water), and a slag deposit (not used).

A water recycling facility is in operation. It comprises a water recycling system in the casting area of the electrolysis shop, the compressor station, the silica sub-station, and in the sulphuric acid shop. Wastewater from the gypsum storage facility is not discharged but recycled in the polyphosphates production. There are no wastewater treatment facilities.

The Centre for State Sanitary Inspection conducts daily monitoring of air quality in the habitation zone and also determines the total pollution coefficient, which must not exceed one. This coefficient was exceeded three times during the period of double super-phosphate production. However, since 1995 the coefficient has not exceeded 1 and varies between 0.5 – 0.9.

The City Sanitary Inspection at the permanent control point located in the habitation zone conducted tests as follows:

- 5,392 tests in 1998. No violations were registered.
- 1,986 tests in 1999. No violations of maximum allowed concentrations were registered.
- 2,196 tests in 2000, 2 of which indicated violations of maximum allowed concentration of solids (maximum 1.2 times the allowed value).
- 11,988 tests in 2001. No violations of maximum allowed concentrations were registered.
- 9,993 tests in 2002, 2 of which indicated violations of maximum allowed concentrations of SO_2 and dus_t (maximum 1.2 times and 1.1 times the allowed value respectively).

An analysis of changes in pollutant emissions and discharges as they relate to the implementation of environmental measures, technology changes and reconstruction, are presented in tables 18 and 19.

Table 18. Pollutant emissions (tons/year)

Year	1992	2001 *	2002 *	Reduction compared to 1992 (times)
Pollutants emission	7,735.7	3,132.138	4,984.336*	1.55
Including:				
Solids	2,855.8	719.417	2,308.433	1.2
Gases	4,879.9	2,412.721	2,675.903	1.8
Gases include:				
Fluorine	252.6	16.414	15.609	16.2
Sulphur anhydride	2,387.5	556.505	937.926	2.5
Carbon oxide	1,644.5	1,571.746	1,370.575	1.2

* The increase in pollutant emissions in 2002 compared to 2001 is connected with an increase of the production and the controlled ingredients list.

Table 19. Pollutant discharges (tons/year)

Year	1992	2001 *	2002 *	Reduction compared to 1992 (times)
Suspended matter	3,180.5	178.030	198.7*	16
Petroleum products	9.0	0.971	1.8	5
Total nitrogen	157.6	9.922	12.33	12.8
Total phosphorus	820.2	16.707	16.03	51.16
Fluorine	77.9	2.943	2.262	34.3
Sulphates	2,049.3	288.826	315.7	6.5
Aluminium	58.3	1.622	2.158	27.0
Iron	4.0	1.267	1.563	2.6

* The increase in pollutant emissions in 2002 compared to 2001 is connected with an increase in the wastewater volume.

Radical changes took place in the mill in 1995 - cement and alumina production were suspended, super-phosphate production was restructured and only one technological system remained operating in the production of sulphuric acid. The creation of new types of products (fluxes, fluxed phosphate, and sulphur oxide potassium) used available gas cleaning equipment, with the load being lower than designed.

The measures outlined have had positive effects on the quality of the river water, particularly with respect to fluorine and phosphates. During the last 5 years, the 1-2 violations of maximum allowed concentrations in the habitation zone were only exceptions to the rule.

Data on river tests above and below the discharge point of process wastewater are presented in table 20.

Table 20. Comparative data on river water tests above and below the discharge point of process wastewater

Year	1992		2001		2002	
Pollutant (mg/l)	**Above**	**Below**	**Above**	**Below**	**Above**	**Below**
Suspended matter	11.1	14.6	39.324	43.26	41.52	44.36
Petroleum products	0.07	0.1	0.054	0.062	0.09	0.1
Total nitrogen	2.1	2.6	1.49	1.7	1.308	1.492
Total phosphorus	0.21	0.76	1.28	1.4	0.162	0.192
Fluorine	0.15	0.57	0.19	0.21	0.134	0.2
Sulphates	18.3	28.3	48.74	51.92	44.645	46.865
Aluminium	0.017	0.06	0.38	0.42	0.292	0.324
Iron	0.5	0.6	0.37	0.41	0.296	0.308

During 2002-2003 the water composition was tested for 23 pollutants. The data presented show that despite a considerable reduction in air and water pollution, the mill still has a negative impact upon water quality in the Volkhov river.

A comparative analysis of JSC Volkhov Aluminium actions with HELCOM recommendations is presented in table 21.

Table 21. Comparative analysis of the results obtained by JSC Volkhov Aluminium related to HELCOM Recommendations

HELCOM Recommendation 17/6	**JSC Volkhov Aluminium**
Wastewater discharge	
Do not discharge phosphogypsum	Yes
Multiple use of process water	Partial water recycling
Waste water treatment	No
Load kg/t	
Phosphorus (0.05 kg/t)	0.7 kg/t
Fluorides (0.3 kg/t)	0.08 kg/t
Air Emissions	
Wet cleaning of discharged gases (fluorides, phosphorus acid aerosol)	Treatment in two absorbers, drop trap
Fluorine compounds- 5mg/ m^3	Less than 3mg/m^3
HELCOM Recommendation (20E/6)/23/11	
Discharges	
Separation of process and cooling water	No
Treatment of discharge	No
Multiple use of process water	Partial water recycling
COD < 250 mg/l	40 – 65 mg/l
Total phosphorus (2mg/l)	16.0 mg/l
Total nitrogen (50mg/l)	5.5mg/l
Copper (0.5 mg/l)	0.023 mg/l

Problem analysis and action plan

Problems

1. No treatment of wastewater.
2. Inefficient operation of electric filters located post furnaces in flux production.
3. Outdated equipment in sulphur acid production.

For many years Volkhov Aluminium has struggled to remain financially viable, and has operated on the brink of bankruptcy. The mill's financial status did not allow for addressing even the smallest of problems. During the period 1990-1993 attempts were made to solve the problem related to wastewater discharge, however, the design of waste-free operations for the mill proved to be unrealistic. Furthermore, construction of rainwater treatment facilities was incomplete, and when some production facilities were suspended, further construction became economically infeasible.

One important factor is that the mill is old. Additionally, there are many processes and infrastructures necessary for production, which make wastewater treatment even more difficult and there are no flow meters installed to register wastewater discharge. In recent years some products were changed and wastewater production was reduced from 3,609,000 cubic meters in 1992 to 1,690,500 cubic meters in 2000.

A major source of dust emission is flux production, and electric filters put into operation in 1959 are highly worn.

Approximately 90% of the sulphur oxides discharge comes from sulphuric acid production at a shop that has been operating since 1962. Apart from double contact and double absorption, no other reconstruction work was done. Over time the equipment has become outdated, and has caused some accidents.

Plans for the mill

1. To provide environmental safety for water discharge systems, as well as technical and process water supply.
   - Construction of a wastewater treatment facility before the main wastewater outlet of the mill.
   - Phase-by-phase reduction of wastewater discharge, depending on financial resources.
   - Phase-by-phase construction of a sludge treatment facility and several local wastewater treatment facilities along with restoration and further use of existing idle facilities
   - Development of zero-discharge system for water supply to the mill.

2. Reconstruction of the sulphuric acid shop.

Expected outcomes of the programme

1. Treatment of wastewater from the D=800 mm, 1,000 mm, 1,200 mm collectors (1,397 m^3/year) in addition to recycling measures will improve water efficiency by 33% of the annual total mill demand, while wastewater discharged into the Volkhov river will be cut down to 86%.

2. Dehydration of the sludge generated at the mill's wastewater treatment facilities will result in a reduction in pollutants discharged (suspended matter) into the Volkhov river by up to 60%.

3. Implementation of the project related to sulphuric acid production will significantly improve the reliability of the technological equipment; in turn this will help to reduce the discharge of sulphates into wastewater and prevent oxidation of process wastewater. It will also maintain air pollution at environmental safety levels.

Conclusions

Implementation of the prescribed actions is dependent on the financial capacity of the mill, and it is unlikely that the problems identified will be solved in the near future under the present economic conditions. It should also be considered that until now environmental problems at the mill have been addressed without any external assistance; this means that further essential modifications will not be possible before 2007.

Hot Spot No. 14
Syaasky Pulp and Paper Mill (wastewater treatment, air pollution) in the Leningrad Region

Syaasky Pulp and Paper Mill was built in 1928. It is located in the town of Syaastroi near the Ladoga Lake.

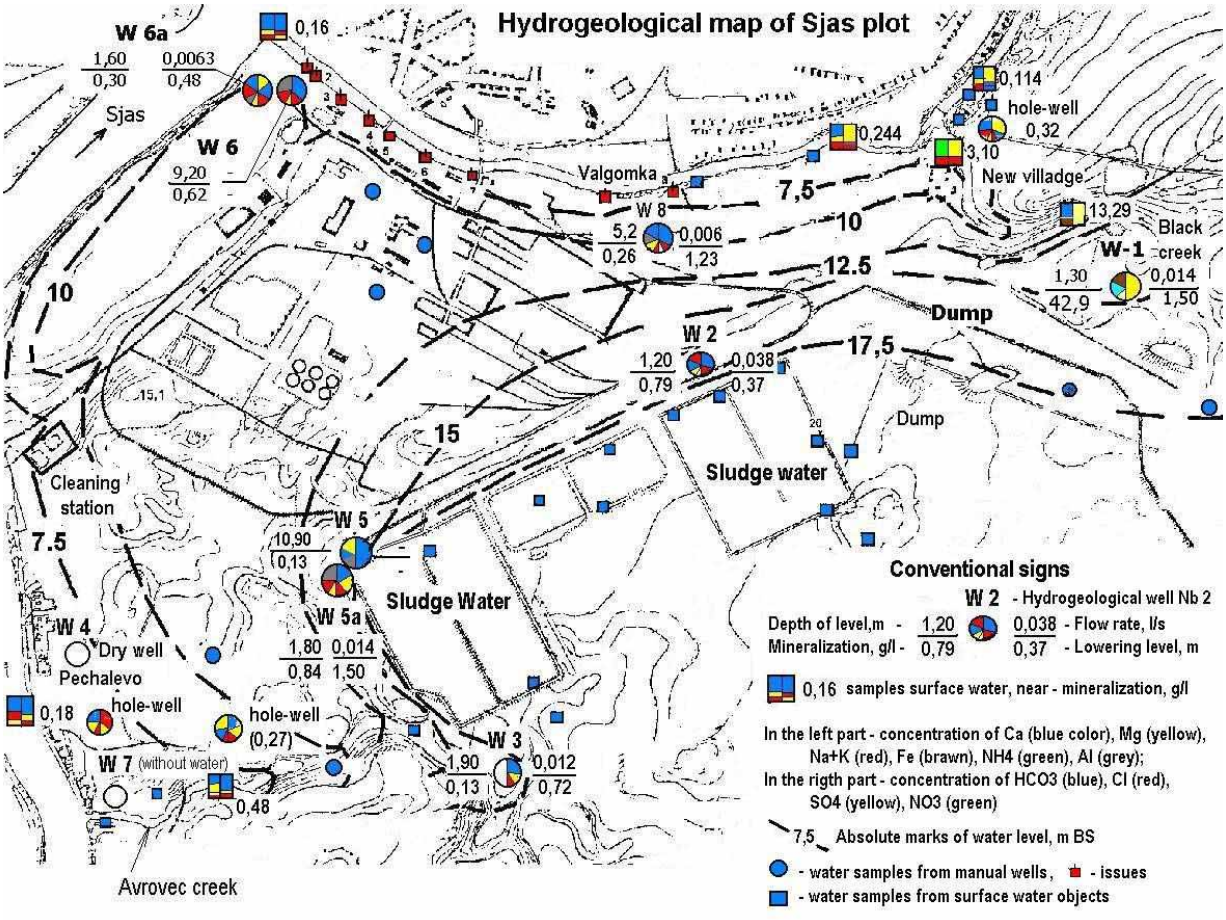


Figure 6. Hydrological map of Syaasky Pulp and Paper Mill location

Description of the Hot Spot (1992)

Design capacity:

- 120,000 t/year of cellulose,
- 100,000 t/year of wood pulp,
- 50,000 t/year of cardboard,
- 52,700 t/year of toilet paper,
- 8,600 t/year of wrapping paper,
- 750,000 dekalitre/year of ethyl alcohol,
- 3,500 t/year of feed yeast,
- 105,000 t/year of lignosulphates,
- 25 t/year of vanilla,
- 500,000 m^3/year of insulation boards.

General description of production technology

Pre-processing of wood: up to 700,000 m^3/per year (coniferous wood) and up to 300,000 m^3/per year (deciduous wood) and wood chipping at the wood pre-processing shop in three production lines.

Cellulose production

1. Acid-cooking shop

To produce cellulose the mill uses 7 boilers with a capacity of 267 m^3 each. 2 boilers have bi-metal and mono-metal walls. Feed time is 9-10 ¼ hours, and cooking is performed using a sulphite technique in an acid and calcium-sodium base.

2. Bleaching shop with flushing and cleaning division

Bleaching of cellulose is conducted in 6 separate towers using chlorine and hypochlorite. Cleaning of cellulose is effected with refiners, centricleaners, and nut traps. A 3-stage process of filters flushing is used. Shop capacity is 400 t/day.

3. Paper drying shop

This shop was commissioned in1928, and is used for sulphite-bleached cellulose production and production of roll semi-product and wrapper.

Production of chemical-mechanical mass

The mill was put into operation in 1978. Wood chips are impregnated with an alkali solution of sodium mono-sulphate at 800°C (10-20 kg/t NaOH, 20 kg/t Na_2O_3) in treatment tanks with a capacity of 300 t/d. Actual capacity is 66,000 t/d including up to 24,000 t/d of final product.

Production of insulation boards

This facility started in 1953, producing soft insulation fibreboard from waste Production capacity is 500,000 m^3/year.

Paper and cardboard production

1. Toilet paper shop

Commissioned in 1969. Two paper machines produce base sanitary and toilet paper, with a production capacity of 52,700 t/year.

2. Sanitary and household products shop

Commissioned in 1970. Base paper is processed to make hygienic products such as toilet paper, napkins, towels, hygienic packs, and baby diapers.

3. Cardboard and paper factory

Commissioned in 1977. The plant produces cardboard (“chrome-ersatz” cardboard, two-layered cardboard, wallpaper, coated and uncoated cardboard). The cardboard machine has a capacity of 75,000 t/year.

Production of ethanol and feed yeast

1. Alcohol shop

Commissioned in 1935. At this facility, sulphite cooking liquor generated during cellulose cooking (70% separation, 3,500 m^3/d of cooking liquor) is subjected to biochemical treatment and converted into raw spirit (hexose) in 5 towers (capacity 40 to 50 m^3/h each) and into spirit in 2 spirit columns.

2. Yeast shop

Commissioned in 1962. The design capacity is 2,500 t/year. It produces cooking liquors for feed yeast (pentose).

3. Evaporation shop

Commissioned in 1970. Concentrated cooking liquors are vaporised at evaporation stations at rates of up to 150 t/h and the residue is sold as lignosulphate.

4. Vanilla shop

Commissioned in 1952. This plant features vanilla production from lignosulphates (design capacity is 25 t/year).

Water supply

The mill pumps water for production and other needs from the Syaas River. Specific consumption of water in different production processes is determined periodically by taking measurements. Table 22 presents data on the specific consumption of raw water during different production processes.

Table 22. Specific consumption of raw water (1992)

Products	Specific consumption of raw water (m^3/t)
Sulphite cellulose, bleached	500.4
Hygienic/ thin paper	667.6
Wrapping paper	197.6
CMM	59.5

Wastewater treatment

A fibre trapping station which extracts fibre from waste water was put into operation in 1959 and its capacity is 87,000 m^3/d.

An individual treatment unit (settler) for wastewater containing bark was put into operation in 1970; the capacity is 14,400 m^3/d.

An acid waste neutralisation station was commissioned in 1978. Its throughput capacity is 2,500 m^3/hour.

A wastewater clarification station where wastewater is treated with alumina was put into operation in 1986. The treatment capacity is 1,100 m^3/d.

A sludge dehydration plant with three drum filters and an air blowing station with a capacity of 176,000 m^3/h, and a stand-by sludge receptor of 1,000 $m^{3,}$ was put into operation in 1989.

The wastewater facility treats 129,827 m^3 of wastewater daily. The BOD_5 load is 33 t/d, and the suspended substances load is 14 t/d. The purification efficiency in terms of BOD_5 is 94.1 % (13.5 mg/l in treated wastewater), and 86.2% for suspended substances (29.3 mg/l in treated wastewater).

Emissions

Solids: 2,460 t/year,
SO_2: 5,420 t/year,
NOx: 561 t/year.

Solid waste

The quantity of dumped solid waste (including bark, wood waste, and excessive active sludge) is 30,000 t/year. The total solid waste from power boilers (ash which is deposited in special dumps) is 18,600 t/year.

Thermal Power Plant

Thermal Power Plant 1 with a capacity of 20 to 40 tons of steam/h was put into operation in 1928. It comprises six steam boilers, and is fuelled by milled peat, and two turbine generators (6,000 kW/h).

Thermal Power Plant 2 was put into operation in 1968. It comprises five steam boilers and three turbine generators (6,000 to 8,400 kW/h). Three boilers are powered by coal while two boilers are fuelled by heavy oil.

The average consumption of steam is 370 t/h (requirement completely met), and of electric power 46,600 kW/h (34.4% of requirement).

Remedial projects and programmes

1. Construction of sludge deposit.
2. Restructuring of the cooking plant and replacement of drainage system for cooking boilers.
3. Construction of a pilot unit to produce beams and boards from wood waste.
4. Reconstruction of Power Plant 2.
5. Construction of car washer equipped with recycling system.
6. Installation of two steam boilers to incinerate bark.
7. Gas supply. Reconstruction of power boilers and conversion to natural gas usage.
8. Introduction of water recycling system.
9. Reconstruction of the process water biological treatment facility.
10. Reconstruction of steam boilers Nos. 7 and 8 and transition to natural gas utilisation.
11. Installation of fibre retaining unit.
12. Development of norms for maximum allowed concentrations in discharges, emissions and dumps.

Programme implementation (1992 – 2003)

1. Construction of sludge deposit was completed in 1993.
2. Reconstruction of the cooking plant and replacement of drainage system for cooking boilers was partially completed.
3. Construction of a pilot unit to produce beams and boards from wood waste was not completed.
4. Reconstruction of Power Plant 2 was completed in 1996.
5. Construction of car washer equipped with recycling system was not completed.
6. Installation of two steam boilers to incinerate bark was not completed.
7. Reconstruction of the biological treatment facility is in progress.
8. Reconstruction of power boilers and conversion to natural gas utilisation was completed in 2003. All 5 power boilers are now powered by natural gas.
9. Development of norms for maximum allowed concentrations in discharges, emissions and dumping was completed.
10. Rehabilitation of the water recycling system is still in progress.
11. Installation of fibre retaining unit. This project is at the stage of selection of technological equipment and manufacturing plant.
12. Device for assessment of water diversion flow was installed in 2002.

13. Device for assessment of treated wastewater discharged into the Ladoga Lake was installed.
14. Plan developed for transmission of storm water from outputs No. 2 and No. 3 to existing industrial wastewater treatment plant.
15. Safety declarations for hydraulic works in the mill were elaborated.
16. The company "BumTechno" carried out industrial tests on the screw separator PSS 4-520 ("fan separator") for dehydration of wastewater sludge to select the standard size of the separator and to determine flocculant consumption. The mill received an economic offer from the company to purchase the commercial device.
17. Selection of "PALL" filtering devices for oil system of the paper-making machine was made, and the devices produced.

Actual Hot Spot status (2003)

JSC Syaasky Pulp and Paper Mill produces commodity bleached sulphite cellulose, commodity mechano-chemical wood pulp, base sanitary paper, toilet paper, paper napkins, and feed yeast. It also generates thermal and electrical energy.

In 2003 the mill turned to cooking of cellulose using a modified bisulphate technique with acid in a 100% sodium base. Plans are in train to prepare cooking acid in a 100% magnesium base in 2004.

In 2003 the first stage reconstruction of the paper-making machine for production of cardboard was carried out, at a cost of four million dollars. At present the process for production of two-ply cardboard (white top-liner trademark) has been outlined, and the second stage of the reconstruction is due to be completed in 2004, after which it will be possible to produce high quality enamel-cardboard.

The following construction projects are currently in progress at the mill: a wastewater plant providing mechanical and biological treatment of wastewater; two sludge deposits and six wastewater outputs: No. 1 discharging treated industrial wastewater into Ladoga Lake and Nos. 2-6 discharging storm water into the river Valgoma.

Reconstruction of the process
The wastewater treatment facility has undergone major improvement, and wastewater from the sludge deposit is returned to the industrial wastewater treatment plant for treatment.

The control of the wastewater treatment plant, the wastewater quality, and the hydrochemical quality of water bodies is being performed by the accredited laboratory of the Environmental Protection Department of JSC Syaasky Pulp and Paper Mill and by the accredited laboratory of the Institute of Toxicology of the Ministry of Health of the Russian Federation.

The water recycling system that has been partially restored is currently operational at the mill.

Air quality control in the vicinity of the mill is being carried out by the accredited laboratory of the Environmental Protection Department of JSC Syaasky Pulp and Paper Mill. Control of the air quality in the residential district of Syaastroy town is being undertaken by the Center for State Sanitary Epidemiological Inspection of Volkhov. There have been no reports of violations of concentrations of the controlled variables.

Results

A comparative analysis of the impact of Syassky Pulp and Paper Mill on the environment in 1992 and 2002 is presented in table 23. An analysis of the results obtained by JSC Syassky Pulp and Paper Mill related to HELCOM Recommendations is presented in table 24.

Table 23. Analysis of Syassky Pulp and Paper Mills impact on the environment in 1992 and 2002

Parameters/year	**1992**		**2002**	
Discharge	46.6 million m^3/year, 129,827 m^3/day		39.6 million m^3/year, 108,488 m^3/day	
	tons/year	**mg/litre**	**tons/year**	**mg/litre**
Suspended matter	1,180.3	29.3	1,195	30.2
COD	29,871	641	41,677	1,053
BOD	1,131.8	13.5	1,257.2	31.8
P total	21.2	0.45	28.1	0.71
N total	286.5	6.15	264.9	6.7
Emissions, total	10,493		866.04	
Solids	2,460		26.33	
Gases	8,033		840.62	
SO_2	5,420		177.35	
Nox	561		523.60	
CO	1,955		27.93	
Cl_2	0.164		0.067	
Waste	30,000		35,522	

Table 24. Comparative analysis of the results obtained by JSC Syassky Pulp and Paper Mill related to HELCOM Recommendations

HELCOM Recommendation 16/4		**JSC Syassky Pulp and Paper Mill**
Sulphur compounds emissions: 1.5 kg S/ton of pulp produced		1.96
HELCOM Recommendation 17/9		
Average annual peak discharge, kg/t ADP (Bleached sulphite cellulose production)		
COD	70	461.6
AOX	0.5	-
P total	0.08	0.3
N total	0.7	2.9
Molecular chlorine should not be used for bleaching after 01.01.1997		Used

Work done in 1997-2003 relating to the gasification of the power boilers resulted in lower emissions into the air: by 91.7% for volatile matter; SO_2 by 96.7%; and NOx by 6.7%. The quantity of waste dumped per ton of cooked cellulose remained the same.

Significant results were achieved only in air protection, which involved large-scale and expensive measures such as gasification of the power boilers.

Further actions

It is necessary to introduce best available technologies (BAT) for sulphite cellulose production, gas cleaning and wastewater treatment in order to improve the status of this Hot Spot.

The following measures have been outlined for the reduction of pollutant discharges:

- Gradual elimination of storm water discharges into the River Valgoma and connection of wastewater discharges to the industrial wastewater treatment plant
- Reconstruction of the aeration process for the biological treatment of wastewater
- Introduction of local wastewater treatment processes using water recycling for toilet paper production.

The installation of screw separators for dehydration of wastewater sludge and thereby reduction of the sludge deposit load has been planned.

The following measures have been identified for reduction of the waste deposit volume:

- Installation of small chipping machine (MPM – 20) for use of wood chips in sulphite cooking process
- Construction of two power boilers to be utilised for solid waste incineration.

Introduction of filtering devices into the oil system of the paper-making machines has been planned in order to reduce industrial waste oil.

Addressing the environmental problems at this Hot Spot will come at a significant cost. In view of the present financial situation of the mill, its removal from the Hot Spot list cannot be achieved in a short period of time without financial support.

HAZARDOUS WASTE

Hot Spot No. 23
State Unitary Environmental Protection Enterprise Poligon "Krasny Bor" (management of hazardous wastes) in Saint-Petersburg

Description of the Hot Spot

The state unitary environmental protection enterprise Polygon Krasny Bor collects, processes and deposits toxic industrial wastes from enterprises located in St. Petersburg and the Leningrad region. It is supervised by the Committee for Nature Use, Environmental Protection and Ecological Safety of the St. Petersburg City Administration.

The Polygon (dump site) has an area of 67.8 hectares, and is located 30 km away from St. Petersburg and 6.5 km south-east of the town of Kolpino, in the Tosno district of the Leningrad region, between the Tosna and Izhora rivers.. The actual area of the dump site is 52 hectares, and the distance between the dump and other settlements is as follows: Nikolskoye settlement is 2.5 km to the east, Krasny Bor settlement is 1.5 km to the south-east, and Feklistovo village and Myshkino are 1.2 km to the south. A clay mine is located 1 km to the west and the Ust-Tosno covered municipal and construction waste dump is 0.4 km to the north. Agricultural fields are located 0.2 km to the south and 2.5 km to the north-west of the Polygon. Mixed type woods are located very close to the Polygon in its eastern, northern and western parts. The terrain is flat, sloping north-east towards the Tosno River and north-west to the Bolshaya Izhorka River.

A ditch runs along the outer limit of the dump to catch surface water from the adjacent territory. It is connected with the main channel flowing into the Bolshaya Izhorka River.

Major types of activities at Krasny Bor

1. Collection and transportation of industrial wastes from St. Petersburg and the Leningrad region enterprises to the dump.
2. Processing, recycling and deposit of industrial toxic wastes.
3. Laboratory analysis of industrial wastes coming from the city and regional enterprises and organisations. Environmental monitoring in the sanitary zone of the dump.
4. Construction of industrial waste processing plant – customer service function.
5. Development and implementation of environmental technology to reduce negative impacts on the environment.
6. Collection and de-mercurisation of used luminescent lamps (re. HELCOM Recommendation 18/5).

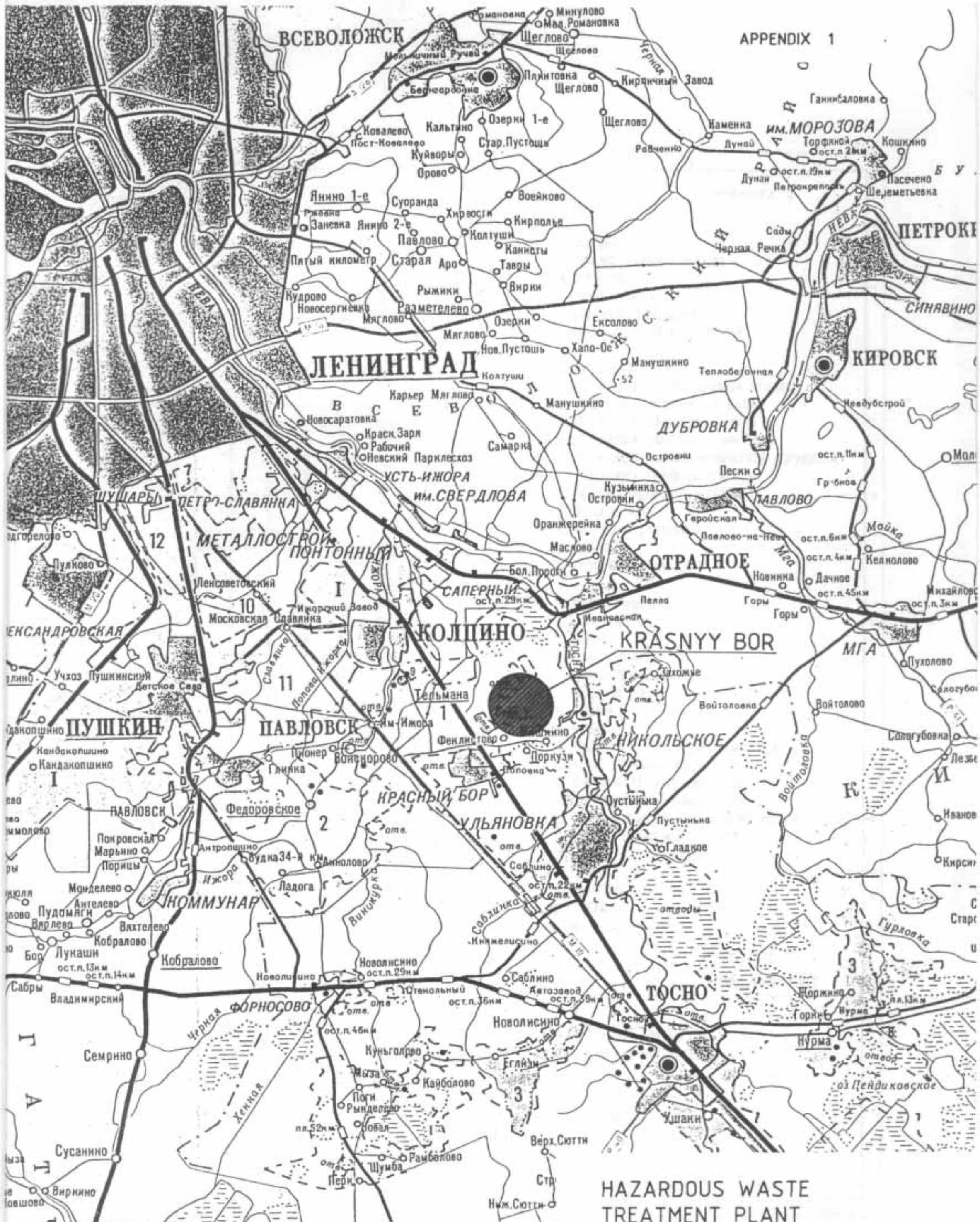


Figure 7. Location of the Poligon Krasny Bor

Problems

The dump poses a threat because of:

1. The location of the dump upstream of the St. Petersburg water intake and its possible influence on the quality of the water in the Neva River.

2. The deposit of more than 1.5 million tons of toxic industrial wastes in the dump, with only about 600,000 tons disposed of in 6 pits (data from 2003).

Major possible environmental impacts:

- Outflow of polluted waters: In the event of extreme natural phenomena (long rains and floods), the open dumps can overflow, thereby damaging surrounding dams and allowing polluted water to enter the Neva River.

It should be noted that such situations have been anticipated. Personnel are prepared to act to prevent an outflow of polluted water from the dump. These emergency measures are only temporary however, and designed to cope with the situation until a new toxic industrial waste processing plant is put into operation. They do not represent a long term or permanent solution to the problem.

- Possible leakages from the dumpsite.

- Atmospheric pollution. The major sources are incinerators, which operate without gas cleaning equipment; the other sources are the six open pits filled with wastes. Decommissioning of the pits is of major concern.

The problems outlined above arise from the fact that the technology currently applied is outdated, of inadequate capacity, and does not comply with current environmental laws.

A fundamental change in the situation will take place only when a new toxic industrial waste processing plant is put into operation.

Measures implemented to improve the technology and environmental status since 1992

Improvement of the environmental situation at this Hot Spot is closely related to the modernisation of its technological processes and the construction of a toxic industrial waste processing plant for handling wastes.

At present construction is in progress on the first complex of the first phase of the processing plant. Completion of the construction of the first complex is scheduled for 2004.

Pits Nos. 39, 50, 52, 56, 62, with a total open area of 26,000 m^2 and a total volume of209,000 m^3 have been closed. Pit No. 70 is being closed. The area of Pit No. 70 has been reduced by 50%, which is 6,800 m^2.

An experimental site for re-vegetation of the Poligon Krasny Bor area is under construction. The site will serve as a model for later re-vegetation of all closed pits.

Actual Hot Spot status (2003)

During the last 30 years the SUEPE Polygon Krasny Bor has received more than 1.5 million tons of toxic industrial wastes. The processing and depositing technology is completely outdated and the impact of the enterprise upon the environment does not comply with the requirements of current environmental law. Wastes are deposited into dumps (pits) made in the water-impermeable Cambrian clay. Precipitation gets there as well, adding to wastes. Liquid waste is treated by thermal decontamination units. They are old in design and their efficiency is poor. As a result, about 700,000 tons of liquid toxic waste is deposited in the dump, and the pits are over-filled. The territory allocated to the Polygon is completely used up. Should any extreme natural phenomena occur (long rains or unexpected floods), surrounding dams can be damaged and the Neva river water – the only source of raw water for St. Petersburg (a city of five million inhabitants) - and the Baltic Sea can be seriously contaminated. This possibility has already been discussed by the Security Council of the Russian Federation, Federal Security Service and the Ministry for Extreme Situations.

The quantities of industrial toxic waste received by the Polygon during the period 1990-2001 are presented in table 25 and figure 8.

Table 25. The amount of toxic industrial waste received by the Poligon during the period 1990-2001.

Years	Total (tons)	Solids	Liquids, Organic	Liquids, inorganic	Galvanic waste	Especially harmful
1990	106,604	22,668	64,250	16,790	516	615
1991	104,732	29,629	57,149	12,034	541	363
1992	54,773	16,255	32,056	6,063	178	220
1993	36,879	11,860	20,704	3,940	135	210
1994	24,336	7,562	13,533	2,720	97	424
1995	18,738	5,393	10,890	2,200	46	209
1996	14,866	3,938	8,310	2,419	70	129
1997	12,008	2,947	6,697	2,115	28	163
1998	9,863	2,662	4,899	1,676	9	124
1999	13,621	6,484	5,672	960	392	114
2000	12,739	5,381	6,334	798	85	141
2001	18,530	10,295	6,713	845	48	630

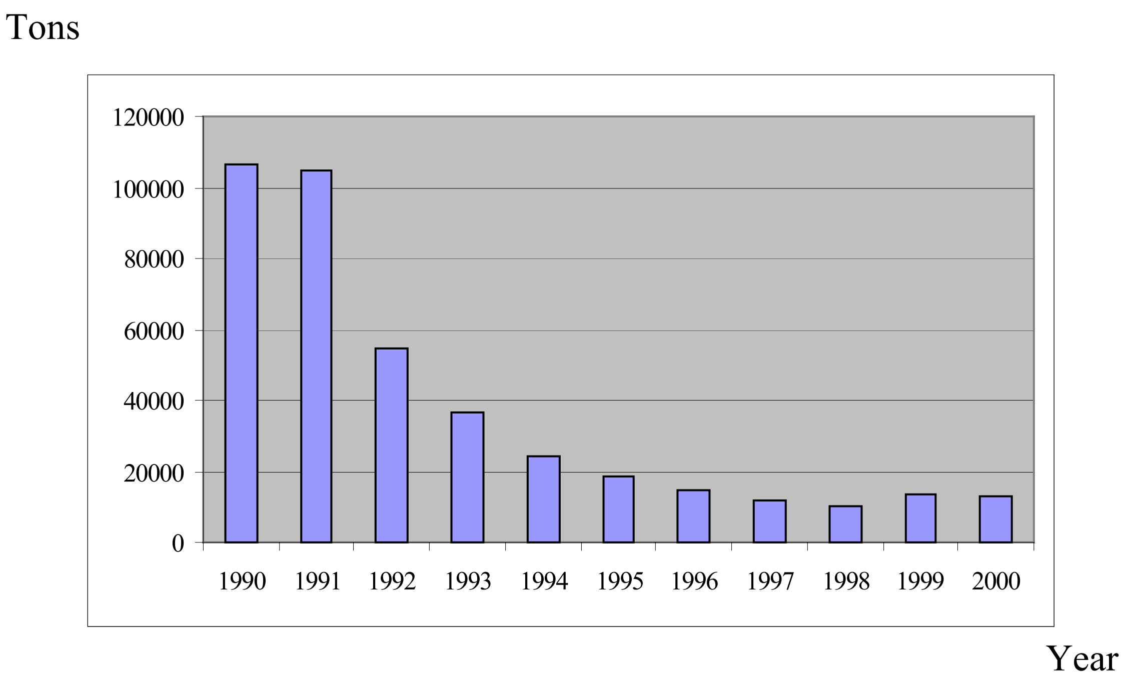


Figure 8. Quantities of toxic industrial waste (tons) received by the Poligon (1990-2001)

The development of the Hot Spot between 1992 and 2002 is presented in table 26.

Table 26. Improvement of the Hot Spot status

Status indexes/ year	**1992**	**2002**
Emissions (tons)	409	52
Discharge (tons)	-	-
Waste handled (tons)	54,773	14,520
Number of open pits	10	6 (area reduced by 29,800 m^2)
Unprocessed waste (tons)	890,000	600,000

Problems pertaining to hazardous waste management, processing and disposal

1. Inadequate accumulation and deposit of toxic industrial waste in the region are due to lack of proper control and the number of organisations transporting and processing industrial wastes
2. Utilisation of petroleum polluted wastes
3. Gap between waste generation and disposal
4. Charges levied upon enterprises for depositing toxic industrial wastes at the Polygon is a deterrent to use of the facilities
5. No distribution of responsibilities between controlling and supervising bodies
6. No land allocated to the new toxic industrial waste processing plant.

Figure 9. Training for accident prevention during transportation of toxic industrial waste to the Polygon Krasny Bor

Conclusion

The SUEPE Polygon Krasny Bor can be removed from the list of Hot Spots only after the 1st phase of the toxic industrial waste processing plant is put into operation and the majority of rehabilitation work on the open pits is completed.

Construction of the first complex of the toxic industrial waste processing plant first phase has been scheduled for 2004. Completion of the construction of the entire first phase is expected in 2005.

AGRICULTURE

Hot Spot No. 24
Large Livestock Farms (treatment of animal waste) in the Leningrad Region

Description of the Hot Spot

This Hot Spot encompasses four large animal breeding farms SAF (State Agricultural Farm) Novy Svet, SAF Vostochny, SAF Sputnik and SAF Pashsky located in the Leningrad region.

Due to changes in Russia's economic environment, the Sputnik and Novy Svet complexes were closed down. The pig population in the Pashsky complex has been reduced to 360 animals and in the Vostochny complex the population has been reduced to 39,000 animals.

Current agricultural and ecological evaluation of the farms

In October 2003 a special Commission consisting of representatives of the Leningrad Regional Committee for Agriculture of the Leningrad Region Government, the Agricultural and Physical Scientific-Research Institution and the Inter-regional NGO "Association for the Promotion of Field Experiments and Researches", together with representatives of regional agricultural administrations, visited and reviewed the four farms constituting Hot Spot No. 24. Members of the Commission met with representatives of the farms and discussed with them the environmental situation and prospects for development of the farms. They also inspected the waste treatment facilities and studied the methods used for collection, depositing and utilisation of dung. Preliminary conclusions have been based on these inspections. .

1. Novy Svet Complex

This pig-breeding complex is situated in Leningrad region in the village Novy Svet, 10 km from the town Gatchina. The complex was designed for simultaneous feeding of 120,000 animals. It operated for more than 30 years and during that period the maximum number of breeding animals was 75,000 heads. Since 1990 the pig population has been constantly decreasing and in July 2002 the complex was finally closed.

A special system has been used for cleaning, which included dung transport by gravity. The waste was then separated into liquid and solid fractions in the first stage of cleaning, following which the liquid was taken to storage ponds with an area of 8.5 hectares (the second stage of cleaning). The liquid waste was used to irrigate an area of 1,100 hectares. The solid waste was taken to a peat bog 0.5 km away from the central farm where it was mixed with peat, and the resulting mixture transported either to the fields of the pig-breeding farm or to neighbouring farms.

A project for the renovation of the preserved Novy Svet complex is in progress, and a joint Russian-Belgian enterprise "Belroc" has been established to feed 120,000 animals for posterior pork processing. The North-West Institution of Mechanisation and Electrification of Agriculture (NWIMEA) has designed the reconstruction project, which was adopted by the client in July 2003.

Figure 10. Novy Svet Complex. Office block.

Resumption of the pig-breeding process was scheduled for February 2004. Five thousand animals at a time will be purchased and it is projected that the pig population will increase by 1,200 animals each month. It is estimated that the pig population will reach 120,000 animals by the end of 2005.

The above-mentioned project proposal by NWIMEA contains a description of a system for the cleaning of animal waste. The system applies a gravity flow principle to the transportation of dung, a central collector for waste swapping, and closed grounds for storing the solid wastes.

At present, when not in operation, the complex does not pose a threat to the environment. The new project is ecologically safe and it very likely will not pollute the environment. The condition of storage ponds causes some difficulty, as the solid wastes have settled on the bottom of the ponds has not been cleaned for 30 years. The condition of the bog with a large accumulation of peat-dung compost also poses a serious problem, since compost was not moved away from the bog during the centre's last years of operation. The bog is connected to one of the tributaries of the river Sujda and can have a negative impact on the water quality of this river. It is necessary to monitor the water quality in the river Sujda and also to study the ecological condition of the bog and storage ponds.

2. Vostochny Complex

The pig-breeding complex Vostochny is situated in the village Nurma in the Tosnenskiy area. Commissioned in 1973, this complex has a maximum feeding capacity of 108,000 heads. The pig population has been constantly decreasing and according to the data up to 1st October 2003, there were 39,097 animals.

At present a "three-stage" treatment of animal waste is in operation. The daily quantity of waste processed is 1,200 m^3, generating fifty tons of solid waste with 85% humidity. The dung is removed by gravity, following which the waste is separated into liquid and solid portions in the first stage of cleaning. The solid waste is transported to a peat bog 200 km away from the complex, where there are no protective structures for the retention and collection of the waste and storm waters. During the last two years very little peat-compost has been sold and the dung has consequently accumulated. A facility for dehydration was built and put into operation at the complex, but this plant worked for only two years before it stopped functioning. At present it is not in operation.

Figure 11. Vostochny Complex. Dung dehydration facility.

The liquid waste is taken to a precipitation tank and subsequently to storage devices and aerotanks (activated sludge units). The volume of each aerotank is 1,600 cubic meters; there the organic fertilizer is oxidized and the liquid is transported to biological ponds, each with a volume of 380 cubic meters. The cleaned wastewater is discharged into the Igolenka brook, which flows into the river Vojtolovka and later to the river Neva.

Figure 12. Vostochny Complex. Aerotanks for treatment of animal waste.

At present the treatment plant, which has been operating more than 30 years, is in critical condition, and does not provide proper cleaning facilities. The treated wastewater has exceeded the Permissible Limit Concentration (LPC) for nitrogen, phosphorus, potassium, organic matter, and sometimes for phenols. The treatment plant is also used for treatment of wastewaters discharged by the Nurma village, thus increasing the load on the plant. General repairs to the treatment plant have not been carried out, and continued use of the plant in such circumstances may result in an ecological disaster.

The silt storage ponds contain a huge store of solid waste that has not been removed. This has resulted in a reduction of their storage capacity. It is necessary to clean them as soon as possible.

The complex changed ownership in 2002, and is currently known as JSC “Vostochny”. In 2002 attempts were made to restructure the treatment plant at the complex; however the project was not implemented due to the change of ownership.

The reduction of the pig population has not affected the volume of meat sales. Over a period of years the standard of feeding methods has greatly improved, periods of fattening have been reduced, plans for breeding work have been developed and put into action, and new technologies for feeding and reproduction have been implemented.

At present the following activities are in progress at the Vostochny:

- Reconstruction of automatic fodder delivery in the section for growing animals
- Testing of automatic feeders, produced by firms “Agroproduct” and “BigDatchman”
- Negotiations for purchase of equipment for reconstruction of farm.

Apart from this, automatic disinfectant facilities for motor transport have been installed and are in operation at the entrance and exit from the Vostochny territory.

The program for improvement of the technological processes includes the following actions:

- Reconstruction and repair work on the watering system
- Purchase of new equipment for the feed-kitchen (feed pump, pipes, taps etc.)
- Reconstruction of the watering system in the closed sections
- Reconstruction of the heating and ventilation systems
- Constant veterinary inspections in selected laboratories in Saint-Petersburg.

Major emphasis has been placed on the treatment plant, and the following actions have been effected:

- Purchase of new pumps and increase in flows from the receiver to the filtration plant
- Repairs to the vibroshaker and increase in the flow capacity
- Implementation of the second level of treatment, currently working efficiently.

Plans have been developed to purchase additional blowers for the first level of treatment, as well as edge filters instead of vibroshakers in the near future. Cleaning of the silt gathering pond and transportation of valuable fertilizers to the fields of adjacent farms have also been planned. There is also a proposal to launch a plant for processing and production of meat-bone flour made of pigs’ waste in accordance with measures for the prevention of environmental pollution.

3. *Sputnik Complex*

The pig-breeding complex known as Sputnik is situated in the Vsevolozhsky area not far from the village Romanovka, and 22 km from the town Vsevolozhsk.

The first two phases of the complex were built in 1980. The design production capacity of the complex is 250,000 animals at a time. During the time the maximum number of breeding animals at the complex at a time, was 110,000 heads, however the pig-breeding process came to an end in 1998.

A three-stage process for the cleaning of animal waste was in operation at the complex. After cleaning, the liquid waste flowed into a sewage farm (4,500 hectares), where the solid dung portion was mixed with peat and taken to fields in the Vsevoloszhskiy area. At present all peat compost is taken to the fields and it poses no danger to the environment. Wastewater from the sewage farm runs into the river Morje by the drainage system and from horizontal flows and subsequently to the Ladoga Lake.

At present the river water is pure, according to indirect indicators such as the presence of fish and crayfish in the river, and is not dangerous for Ladoga Lake. However, it would be advisable to conduct a study of water quality in the drainage network of the sewage farm and the river Morje.

Figure 13. Sputnik Complex. Wastewater treatment plants.

At present the pig-breeding complex Sputnik is under competitive management. A project for resumption of the pig-breeding process on the third line is currently under consideration. Implementation of this project would require a new treatment plant (unfinished at present), which should operate in compliance with ecological requirements. However, because of a lack of funds, resumption of pig breeding at the complex in the near future would be highly problematic.

Figure 14. Sputnik Complex. Third production line.

4. Pashsky Complex

Occupying 8 000 hectares, the cattle-breeding Pashsky complex is situated in the Volhovsky area in the village Potanino, 132 km off the Murmansk highway. The complex was designed for the simultaneous feeding of 30,000 animals. The first line for 10,000 animals was planned on the basis of Italian technology and began operations in 1975, reaching full capacity in 1980. At the beginning of 1990 the livestock population began to decrease, and at present 360 heads of cattle including 135 cows reside at the complex. . Today, the complex is divided into two areas: Stock Company Kiselnja with 4,000 hectares of land and Pashsky, which is insolvent. All animal buildings are located at the Pashsky complex.

There are no plans to resume cattle breeding at these two farms in the future.

At the former Pashsky complex there is a large quantity of unused dung, which has decomposed and is a valuable organic fertilizer. However, as the area in which dung is stored is not protected from storm water, the solid fraction of the compost and its decay products constantly leak into the drainage network and into the river Pasha and beyond that into the Ladoga Lake.

The problem of decomposed dung needs to be addressed before there can be any improvement in the ecological situation in the area where the Pashsky complex is situated.

Conclusions

For the Sputnik and Pashsky complexes to be removed from the Hot Spot list it is necessary to conduct more thorough investigations into the ecological situation where they are situated. It is particularly important to carry out a study of the water quality in the drainage network of the sewage farms in the rivers Morje and Pasha, and also to resolve the problem of decomposed dung utilisation.

At the Vostochny complex required procedures include a general restructuring of the waste treatment plant, prompt cleaning of the silt storage ponds, and additional investigations into the ecological condition of the areas.

At Novy Svet it is necessary to conduct an expert study of the complex reconstruction project and the storage ponds. An ecological study of the condition of the bogs is required before resuming pig breeding, since there is a large stock of peat-dung compost.

A quantitative analysis to assess the reduction of loads into water basins in the catchment area of the Baltic Sea within the Leningrad region has been planned and will be carried out shortly. The results will determine whether or not Hot Spot No. 24 can be removed from the list.

FINAL CONCLUSIONS

Hot Spots related to urban wastewater treatment plants and industrial emissions and discharges

Between 1992 and 2003, some progress was observed with regard to municipal and urban water supply and wastewater treatment (Hot Spots Nos. 18, 19, 20 and 21) under the leadership of Vodokanal St. Petersburg. Actions taken include the construction of a sewer connection, treatment of municipal and industrial wastewater and phosphorus removal. The closing down of these Hot Spots has been closely related to the issue of solving the problems of sewerage and the St. Petersburg municipal wastewater treatment.

The State Unitary Enterprise Vodokanal of St. Petersburg has set an ambitious long-term goal: to meet HELCOM standards on wastewater by 2015, by implementing the following measures:

- Completion of construction on the South West WWTP, and achieving efficient nutrient removal capacity;
- Completion of construction on the main sewer duct in the northern part of the city which to forward all wastewater from that area to the Northern Aeration Station thereby restoring design capacity loads (1,250,000 m^3/d) and subsequently relieving some of the load from the Central Aeration Station;
- Completion of work targeted at connecting all direct outlets to the pipelines leading to the WWTPs and provision of treatment for almost all household and industrial wastewater, as well as storm and melting water collected from the area covered by the common city sewer system.

Discharges of heavy metals from the metal plating industry (Hot Spot No.22) have been reduced significantly. These reductions resulted from decreasing production caused by the economic depression at the beginning of 1990 on the one hand, and on the other hand, from measures implemented at the large metal-plating production sites located in Saint-Petersburg. To a large extent implementation of new technologies under LIFE projects, with the participation of partners from the Baltic Sea region, contributed to solving the problem of pollution from metal plating production activities. Most of the metal plating production sites located in Saint-Petersburg are now operating in compliance with HELCOM Recommendations.

The "Krasny Bor Landfill" (Hot Spot No. 23) has been processing and depositing toxic industrial waste for 30 years using largely outdated technology. Since 1992 some improvements have been made but there is an urgent need for a new plant. The number of pits has been reduced from ten to six but the landfill area has been fully used, and this is regarded as a threat to the environment and to the water supply of St. Petersburg. Additionally the treatment of toxic waste in the Leningrad Region is considered to be inadequate. The SUEPE Polygon Krasny Bor can be excluded from the list of Hot Spots only after the 1st phase of a toxic industrial processing plant is put into operation and the majority of rehabilitation work on the open pits of the dump is completed.

The initial phase of construction on the first complex in the toxic industrial waste processing plant is scheduled for completion in 2004. Completion of construction of the entire first phase has been planned for 2005.

The "Volkhov Aluminium Plant" (Hot Spot No. 15) produces raw aluminium, polyphosphates, etc. and also generates thermal energy. In 1992 large amounts of harmful substances were released during the production process. The production of cement and alumina has been suspended, the super phosphate production process restructured, and gas cleaning equipment installed. Production of new types of products (fluxes, fluxed phosphate and sulphur oxide potassium) has also been implemented. These remedial measures have resulted in reductions in the emission and concentration of wastewater pollution, particularly with respect to fluorine and phosphate.

Current environmental problems focus mainly on the absence of wastewater treatment, outdated equipment, and insufficient operation of electronic filters. Addressing these problems requires financing, which might be difficult to procure. In a best-case scenario, plans for solving these problems cannot be implemented before 2007.

The "Syassky Pulp and Paper Mill" (Hot Spot No. 14) is equipped with old and outdated technology, and despite efforts to reduce pollution significantly, results have been only achieved regarding emissions into the air. One drawback is the lack of lignosulfonates utilisation, production of which could help reduce COD pollution by 3-4 times. Additionally, plans to modernize different parts of the factory appear to be very costly.

Agricultural Hot Spots

Hot Spot No. 24 relates to four large animal breeding farms: SAF Novy Svet, SAF Vostochny, SAF Sputnik and SAF Pashsky, all located in the Leningrad region.

Due to changes in the Russia economic environment, the Sputnik and Novey Svet complexes were closed down. The animal population in the Pashsky complex has been reduced to 360 animals, and in the Vostochny complex the pig population has fallen to 39,097 animals.

In October 2003 a special Commission consisting of representatives of the Leningrad Regional Committee of Agriculture of the Leningrad Region Government, the Agricultural and Physical Scientific-Research Institution and the Inter-regional NGO "Association for Promotion of Field Experiments and Researches" together with representatives of regional agricultural administrations visited and reviewed the four farms related to Hot Spot No. 24. Members of the Commission met with representatives of the farms and discussed with them the environmental situation and perspectives for development of the farms. They also inspected the waste treatment facilities, and studied the methods used for the collection, depositing and utilisation of dung.

On the basis of the inspection the following preliminary conclusions were made:

- Before the Sputnik and Pashsky complexes can be removed from the Hot Spot list, more thorough investigations of the ecological situation should be conducted in the areas where the complexes are situated. Particularly needed are studies of the water quality in the drainage network of the sewage farms, in the rivers Morje and Pasha, and also a solution for the problem of utilising the decomposed dung.
- A general restructuring of the waste treatment facilities of the Vostochny complex is required in addition to immediate cleaning of the silt storage ponds and additional investigations into the ecological conditions in the area.
- At the Novy Svet complex it is necessary to conduct an expert study of the complex reconstruction project and the storage ponds. An ecological study of the condition of the bog is needed before pig breeding can be resumed, since a large stock of peat-dung compost remains.

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