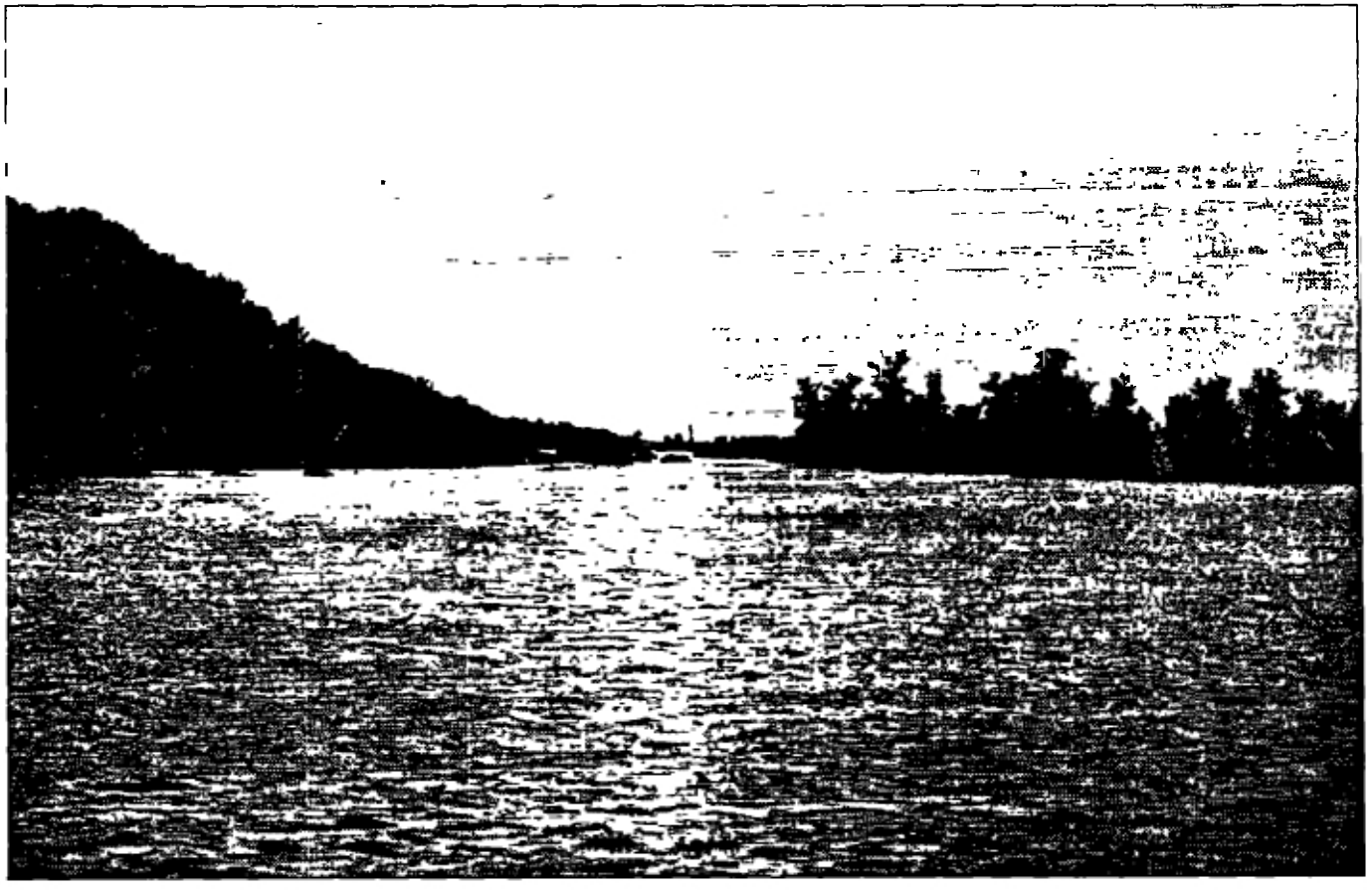
THE VOLGA PROJECT

Two years of cooperation between Milieukontakt Oost-Europa and Russian environmental organizations along the Volga



MILIEUKONTAKT OOST-EUROPA

ВОЛГА
СОЦИАЛЬНО - ЭКОЛОГИЧЕСКАЯ АКЦИЯ

Amsterdam - Nizhni Novgorod, July 1995

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OOST-EUROPA

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AANKONDIGING

RAPPORT OVER VERVUILING EN MILIEUACTIE AAN DE VOLGA

Op 31 juli 1995 verschijnt het eindrapport van het Russisch-Nederlands Volga-project. Het is een verslag over twee jaar samenwerking tussen de Nederlandse Stichting Milieukontakt Oost-Europa en milieuorganisaties langs de Volga, de grootste rivier van Europa. Op basis van de resultaten van zelf uitgevoerd milieuonderzoek naar de vervuiling van de Volga werd een strategie ontwikkeld om de problemen aan te pakken. In de stad Dzerzhinsk, één van de zwaarst vervuilde gebieden, leidde dat al tot resultaten.

Milieuonderzoek van de Volga in het kader van het project toonde aan dat de vervuiling van de rivier vergelijkbaar is met die van de Rijn in de vroege jaren tachtig. Op enkele plaatsen werden 'hot-spots' nader in kaart gebracht.

Met behulp van deze informatie, en ervaring van de Nederlandse milieubeweging, hebben een aantal Russische milieuorganisaties campagnes opgezet om in de situatie verbetering te brengen. In de eerste plaats zijn deze campagnes gericht op verbetering van de lokale situatie. Samen werken de groepen op die manier aan een schone Volga.

Eén van de campagnes leverde al resultaat op: in de stad Dzerzhinsk werd op initiatief van het Volga-project een hoorzitting georganiseerd over de gevaren die de vervuiling van het industriegebied ter plaatse met zich meebrengt. Alle betrokken partijen, overheden, industrie en milieuorganisaties werden het eens over een plan van aanpak, en werken inmiddels samen in een werkgroep om het probleem op te lossen.

Tijdens de uitvoering van het Volga-project is duidelijk geworden dat Russische milieuorganisaties, ondanks de moeilijke economische en politieke situatie in hun land en zeer bescheiden middelen, er in slagen om de besluitvorming met betrekking tot het milieu te beïnvloeden.

Dit project werd gefinancierd door de Nederlandse Stichting DOEN, met middelen van de Postcodeloterij. De Russisch-Nederlandse samenwerking zal nog twee jaar doorgaan, waarbij de Nederlandse inbreng langzamerhand zal worden teruggebracht. Het vervolgproject zal worden gefinancierd door TACIS, een fonds van de Europese Unie.

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The foundation is an initiative of
Friends of the Earth International (FoEI)
Landelijk Milieu Overleg (LMO, National Environmental Forum)
Stichting Natuur en Milieu (SNM, Netherlands Society for Nature and Environment)
Vereniging Milieudefensie (FoE-Netherlands)
World Information Service on Environment and Development (WISE)

The Volga Project was funded by the Dutch private Doen Foundation

STICHTING DOEN! POSTCODE LOTERIJ

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Milieukontakt Oost-Europa is a liaison foundation serving environmental organizations in Central and East European countries and The Netherlands.

INTRODUCTION

This is the final report of the Volga Project, in which the Dutch foundation *Milieukontakt Oost-Europa* co-operated with Russian environmental organizations, over a period of two years, to develop a strategy to combat the industrial pollution of the river Volga. The project - funded by the Dutch private *Doen Foundation* - commenced in February 1993, and continued until April 1995. This report describes the project's activities and results.

Dutch environmental activists, and representatives of Russian non-governmental organizations (NGOs) working in the Volga river basin, first established contact in October 1991, at a conference attended by NGOs from the Volga basin. The conference focused on the environmental problems of the Volga river basin, and was held in the city of Nizhni Novgorod - formerly known as Gorki, and located roughly 450 kilometres east of Moscow. The conference was the second of its kind, and the first to be open to non-Soviet citizens. Nizhni Novgorod had been a city closed to non-Soviets until 1991.

During the conference a general action programme was drawn up for NGOs from the Volga river basin, with input from Dutch environmentalists. The action programme, that grew into a network of Volga NGOs, was called *Let's help the River*. One of the actions to be undertaken was the making of an inventory of the most important sources of pollution in the Volga basin. This was the origin of the Volga Project.

Contacts between Russian and Dutch NGOs were maintained in 1992, and led to a joint Volga Project in 1993. Within the project a research campaign on the Volga was organized. The goal of the campaign was to reach a basic understanding of the most important sources of industrial pollution in the Volga basin. On the basis of the results the environmental NGOs along the Volga developed an action strategy to remove these sources.

The Dutch foundation *Milieukontakt Oost-Europa*, the Russian coordination centre of *Let's help the River*, and several local environmental NGOs along the Volga took part in the project. In addition, Russian scientists collaborated in the research work, and samples were analyzed in Russian and Dutch laboratories.

This report describes the proceedings and the results of the Volga Project.

Chapter One gives a general description of the project's history, goals, and progress. It serves as a summary of the report.

Chapter Two focuses in detail on a case study of the Volosyanikha canal, in the industrial sector of the city of Dzerzhinsk - in the province of Nizhni Novgorod. The case was taken as an example relevant to the pollution of the Volga. A hearing, on the pollution of the canal, was organized in December 1994 in the city of Dzerzhinsk. This chapter describes the process, and conclusions, of the hearing.

Chapter Three describes the participation of the Russian partners in the Volga Project. It describes how cooperation with local NGOs along the Volga was set up, and the significance of the project for these organizations It also lists their activities within the project.

Chapter Four contains a description of the NGOs' environmental research in the Volga basin. For this research Dutch working methods were adapted to the Russian situation. It has become a long chapter, because it describes in detail the methods of research, and presents all research results of 1993 and 1994.

The final chapter draws general conclusions from the two years of NGO collaboration on the Volga Project, and recommends steps to deal with the Volga river's pollution.

Map 1.

The Volga river basin

Contents

CHAPTER 1

THE VOLGA PROJECT

1.1 History

The Volga Project goes back to 1991, when Milieukontakt Oost-Europa had just created the Russia/Belarus/Ukraine project. In October 1991 Anne-Marie Heemskerk, the project's coordinator, was invited to 'Days of the Volga' - the second annual NGO-conference on environmental problems in the Volga basin. Representatives of two Dutch organizations went with her: the *Foundation Reinwater* - which combats the pollution of West-European rivers, and the *Wadden Sea Association* - which is active in the protection of the Wadden Sea in the North of the Netherlands.

At 'Days of the Volga-91' Dutch activists learned from their colleagues in the Volga basin about actions which had been taken in defence of the environment. A campaign in Volgograd was discussed, for example, in which the construction of a second canal between the Volga and Don rivers had been prevented. Examples of other successful actions included the prevention of several nuclear power projects. The Dutch organizations gave lectures on action-tools and international environmental agreements. In addition, they gave advice on strategy in the realization of a general NGO action programme called *Let's help the River*.

One of the activities to be undertaken within the action programme was to draw up an inventory of the most important sources of pollution threatening the river Volga. This was meant as a first step towards an action plan which would remove the major threats to the river's ecology.

In the period after the conference, when Russian non-governmental organizations (NGOs) started to implement the plan, it became clear that specialist support was needed: in several cases there was little knowledge on analytical methods; little experience in using standards and examples, with which data could be compared; and there was a need for more experience in constructively addressing the problem of the Volga basin's pollution. So the idea came up for Russian NGOs to use the experience of Dutch NGOs to implement their plan.

The Dutch environmental movement is relatively well developed, and has particular experience in addressing the environmental problems of river basins. River quality is of major importance in the Netherlands, which is one of the most densely populated and industrialised countries in the world, and the point of confluence for several European rivers. So it was felt that Dutch NGOs could offer valuable experience in the field of river ecology.

After an initial survey of the situation it became clear that Russian NGOs needed support in two fields, which formed the basis of the Volga Project. First, technical support was needed in the analysis of the river's ecology, about which not enough was known. Second, and equally important, help was needed in the interpretation of data, and in the effective use of data in a campaign to combat the river's pollution. In October 1992 Milieukontakt and representatives of the *Let's help the River* coordination centre agreed that Milieukontakt would prepare a proposal for a structural joint project.

This was following a strengthening of contacts since 1991. The coordination centre of *Let's help the River*, in Nizhni Novgorod, received funding from Milieukontakt, and set up an environmental newspaper. In December 1991 Milieukontakt invited Valya Malakhova - one of the people of the coordination centre of the *Let's help the River* action programme - to meet several Dutch environmental organizations dealing with water pollution in the Netherlands. In May 1992 Milieukontakt and *Reinwater* took part in a boat tour called 'Rock for Clear Water', together with representatives of more than fifty environmental organizations. In October 1992 Milieukontakt and the *Wadden Sea Association* participated in the third conference of environmental NGOs in the Volga river basin: 'Days of the Volga-92'. The conference evaluated the Volga NGOs' activities over the past year, and determined priorities for the following year.

1.2 The project proposal

Following discussions with *Reinwater* and the *Wadden Sea Association*, Milieukontakt prepared a project proposal in the autumn of 1992, which was agreed upon by Russian NGOs. The central aim of the project was to contribute to the strengthening and professionalization of the environmental movement in the Volga river basin area, so they would be accepted as serious partners by public authorities and local industries. The project should also raise the level of awareness, internationally, about the pollution of the Volga river.

In order to reach this long term aim, a short term goal was identified, which was to answer the following questions:

-What is the degree of water pollution of the river Volga?
-Who is responsible for the pollution?
-What are the possibilities for Russian environmental NGOs to address the river's pollution?
-What support is needed by the environmental movement in the Volga river basin area?

The project was to consist of:

1. Environmental research.
2. Public reports concerning the project's activities and results.
3. The organization of a hearing
4. Support and training of environmental NGOs in the Volga river basin area.

It was first considered necessary to determine the extent of the river Volga's pollution. Data on this was not sufficient to the NGOs, so primary research was considered a priority. Research - to be performed by qualified scientists in cooperation with local NGOs - was to cover the causes of the Volga's pollution, and was to include an inventory of existing information, and new environmental analysis.

On the basis of this research, several cases were to be selected for study of the economic, political, judicial and social factors behind the pollution. Moreover, local NGOs were to be assisted in the preparation of their cases which would be presented at a hearing scheduled for autumn 1994. These cases were to be discussed with local industries, public authorities, and environmental organizations, and would hopefully lead to the signing of a Code of Conduct by all parties involved. A Russian- and English-language report was planned, to detail the conclusions and recommendations of the both the research and the hearing. The report was to become a tool for further action, and a document which would attract the attention of the general public. Lastly, the experience of taking part in the Volga Project was to have given valuable experience, to NGOs in the Volga river basin area, in approaching the complex problem of the pollution of the Volga river.

Matushka Volga

'Matushka Volga' (mother Volga) is Europe's largest river, with a length of approximately 3500 kilometres. It flows from the Volgoverkhovye (in the North, between Novgorod and Tver) into the Caspian Sea.

Its basin covers 1.4 million square kilometres - one quarter of the European area of Russia. The Volga receives about 200 tributaries, of which the Kama and the Oka are the largest. The average flow of the river, at the point where it flows into the Caspian, is 7710 cubic metres per second – about 3 times that of the river Rhine. The Volga is considered a flat river, with a fall of only 200 metres. It is also a rain river.

The Volga is regulated and seriously influenced by a series of 8 water reservoirs/hydro-electrical installations, the biggest of which are the Kuibyshev, the Volgograd and the Cheboksary. Most were built during Stalin's industrial drive, in the 1930s. Due to the construction of these water reservoirs, the average velocity of the river has decreased by a factor of 10, and a large amount of the sediment carried by the river is now deposited in the reservoirs, instead of being carried downstream into the Volga Delta.

The Volga basin is the most densely populated area of Russia, with a population of about 60 million. The region is of great economic importance for Russia. Various industries are situated along the river, and about a quarter of the industrial production of the former USSR is produced in the Volga region. The Volga is also a main waterway, connecting the Caspian with the Baltic Sea, the White Sea, the Black Sea, and Moscow. In addition, the Volga is very important for the agriculture and fishery sectors.

The pollution of the Volga is a major concern. Even the Big Encyclopedic Dictionary of the USSR (1991) states: "As a result of anthropogenic influences, the ecological condition of the Volga river has seriously deteriorated. Scientificly founded ways to recover the Volga are being searched for."

1.3 Course of the Project

After receiving funding from the Dutch private *Doen Foundation*, Milieukontakt recruited two people to work on the Volga Project. Itske Lulof - the Dutch project coordinator - was stationed for three quarters of her time in Russia, at the coordination centre of *Let's help the River* in Nizhni Novgorod. Joost Rutteman - a representative of *Reinwater* - was recruited as the technical adviser to the project, and worked mainly in the Netherlands, but regularly visiting the Volga area. After the first year he was stationed at Milieukontakt's office in Amsterdam. From the Russian side the project was coordinated by Yelena Kolpakova from the coordination centre of *Let's help the River*. Askhat Kayumov was the adviser to the project from the Russian side.

The four-person coordination team formed the nucleus of the project, and operated from the office of *Let's help the River* in Nizhni Novgorod, making regular visits to other areas of the Volga.

These people were assisted by two volunteers: Nadia Malova in Nizhni Novgorod, who helped during the whole course of the project, and especially with the hearing, and Jeff Colin from Amsterdam, who supplied the coordination team with technical information from the Netherlands, especially during the preparation of the hearing.

1.3.1 The hearing

The idea of a hearing came from the actions of environmental NGOs which had been active in the region of the river Rhine in the early 1980s. In Rotterdam, the Netherlands, in 1983, these NGOs organized an 'International Water Tribunal', in which environmental NGOs from North West Europe presented cases of water pollution, asking a panel of experts to pass judgement on each case. The tribunal became the starting point for many NGO actions directed towards the amelioration of water pollution, and some of the cases were later presented in the law courts. An important feature of the 'Water Tribunal' was the fact that high standards were set both for the argumentation used and the proof supplied, thus raising the quality of later NGO-actions.

But the idea of a tribunal was not simply copied by the Volga Project. A confrontational strategy was successful in North West Europe in 1983. But this was not suited to the situation in Russia in 1994 One of the most important differences was that of responsibility. During the preparation of the International Water Tribunal it was clear who should stand trial for acts of pollution. In Russia in 1994 responsibility was a more complex issue, and Western concepts of responsibility did not fit into the context of the social system of the former Soviet Union.

The approach in Russia had therefore to be more conciliatory. The accusation of 'guilty parties' was not considered to be an appropriate approach. Rather, the aim was to determine the extent of certain problems and to agree on ways to solve them. In this way, responsibility was not determined, but created. The form that was chosen was a hearing - a public debate on specific cases of pollution - which covered research conclusions and recommendations for future action with regards to cases of pollution.

After contacts with NGOs throughout the Volga region, the coordination team concluded that each organization should develop its own action strategy, adapted to local circumstances. This was considered to be preferable to the organization of one large hearing, which would deal with cases from all over the Volga basin. There were two main reasons for this conclusion. Public authorities and local industries, at different places along the Volga, had varying attitudes towards cooperation with NGOs. For example, the relationship between local authorities and the environmental movement in Nizhni Novgorod can hardly be compared with that in Cherepovets. A hearing with participation of the environmental movement and local authorities and industry of Cherepovets would thus require a different strategy. Moreover, it was concluded that the organization of one large, overall hearing would require much more preparation than was envisaged in the project-proposal.

So a decision was taken to assist local NGOs in drawing up a separate action strategy for each separate case, rather than to assist each of them in preparing the presentation of their case in one overall hearing.

Within the project one hearing on a local environmental problem was organized by the coordination team of the project, thereby acting as a local NGO In this way the team was able to transfer its campaigning experience to the local NGOs in the Volga river basin. The hearing focused on a case of serious pollution in the city of Dzerzhinsk - in the Nizhni Novgorod province. NGOs, public authorities and polluters all participated in this debate, and independent experts were present to witness the event and, where necessary, to provide comment.

The organization of the hearing set clear quality standards - to the environmental organizations present - for the substance and presentation of a case. Moreover, it gave an indication of the attitude of government agencies, public authorities, the industry, and the general public. The preparation and the organization of the Dzerzhinsk hearing is described in Chapter Two.

1.3.2 Research

In order to ensure the quality of the scientific research involved in the project, two independent experts were recruited - Marina Adas, from the *Geocentre-Moskva* in Moscow, and Tatiana Shpotova, from the *Centre for Environmental Research* in Obninsk.

At the commencement of research the coordination team usually presented the objectives of the Volga Project to those public authorities who were in some way involved in water quality management. They would then request information concerning water quality and sources of pollution Public authorities were generally helpful to the team, and some authorities were prepared to support - or even take part in - the research, by supplying transport, identifying locations, and by carrying out environmental analysis.

The first environmental research was performed in two regions - the provinces of Samara and Nizhni Novgorod. Preliminary results were presented at `Days of the Volga 1993'. The interpretation and final publication of research took until December 1994. This field- and paper-work was an important experience for the coordination team - not only did it lead to important insights concerning the ecology of the Volga river basin, but it also enhanced the credibility of the NGOs involved, and led to valuable contacts with experts and public authorities.

In the second year of the project more detailed research was carried in the Nizhni Novgorod region, and the coordination team - together with local NGOs - carried out environmental analysis in the cities of Yaroslavl and Volgograd. More information concerning the conclusions of this research is presented in chapter Four

1.3.3 Participating local NGOs

Cooperation with local NGOs was sought at an early stage of the project, which began by sending a questionnaire to a number of relevant organizations in the Volga river basin area. The questionnaire requested information on the most pressing local environmental problems, the possible threat these posed to the river Volga, and the extent to which NGOs would be interested in participating the Volga Project. After the questionnaire had been distributed - and particularly after `Days of the Volga 1993' in which the preliminary research results were discussed - the coordination team visited a number of local organizations to determine the form which cooperation might take. These visits usually took several days, and consisted of discussions on: the Volga Project, the activities of the local NGO, and the nature of the pollution which would be addressed by the project. A visit to the polluted area normally formed part of these visits.

In the second year of the Volga Project, preparations began in the cities of Yaroslavl, Volgograd, Dzerzhinsk and Nizhni Novgorod on ways to address the Volga river's local industrial pollution problems. Due to the nearing winter period, during which it is dangerous to perform research at water reservoirs, no more than an orientation visit could be paid to the city of Cherepovets. Nevertheless, contacts were strengthened with the local organization in this city, and the following year's research was planned.

By taking part in the preparation and execution of the environmental research - including an inventory of existing information, environmental analysis, and data interpretation - local environmental organizations received accurate independent information about the industrial pollution of the Volga river in their region, and gained the skills needed to interpret this information. It was the task of the coordination team to report on the project's (research) results, local NGOs were also successful in organizing local publicity.

In total, three meetings between the coordination team and local NGOs were organized - attended in each case by representatives of all relevant organizations. Aim of the meetings was to encourage cooperation between the participating organizations. The representatives discussed various ways of approaching local environmental problems, and considered the possibilities for a regional approach to problem solving.

More information about the organizations participating in the Volga Project is presented in chapter Three.

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Chapter 2.

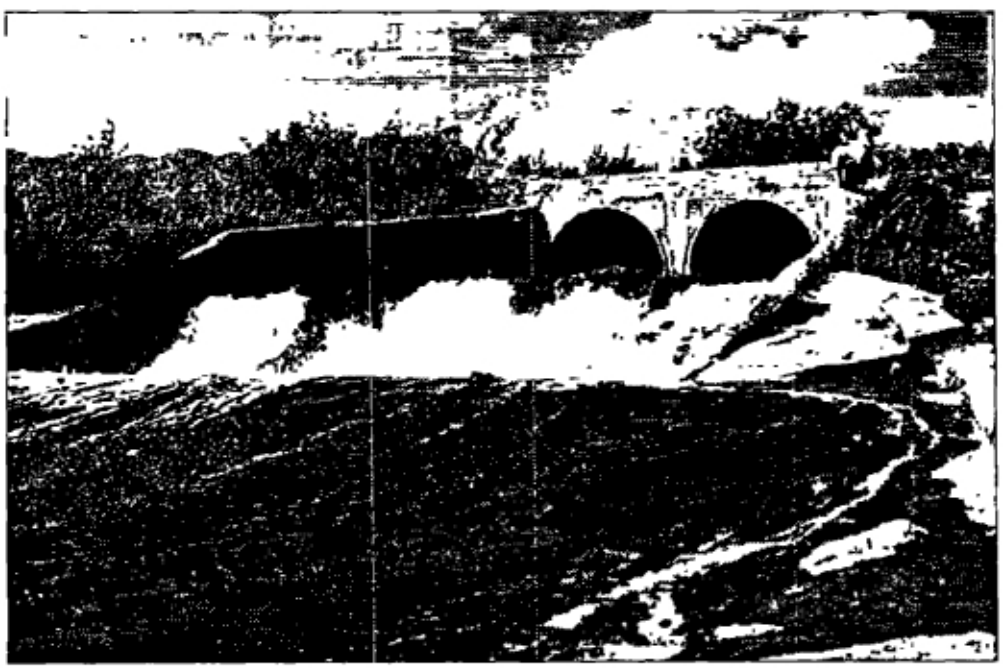
THE HEARING

On December 16, 1994 a hearing was held in the city of Dzerzhinsk (Nizhni Novgorod province) about the pollution of the Volosyanikha canal in the industrial part of the city It was organized by the coordination team of the Volga Project.

This chapter explains why the environmental problem in Dzerzhinsk was chosen as the subject for the hearing. Then it describes how all concerned parties were informed about the research results in the city. Next the preparations and actual event are described. The chapter ends with the results of the hearing, and with conclusions.

2.1 The selection of a local pollution case for the hearing

The evaluation of the results of the sampling campaigns that took place in the Nizhni Novgorod and Samara provinces in 1993 made it possible to point out several prior environmental problems. One of these was the Volosyanikha canal in the city of Dzerzhinsk, about 30 kilometres from the city of Nizhni Novgorod. Dzerzhinsk is one of the most important centres of the Russian chemical industry: predominant is the chlorine-processing industry. A main activity is the production of polyvinylchloride (PVC). In the recent past very harmful substances, like the pesticide DDT and polychlorinated biphenyls (PCBs) were also produced here. In the past, factories discharged waste water, without any treatment, right into the Volosyanikha canal. In the water and the bottom sediment of this canal high concentrations of PCBs, DDT and its derivatives, mercury and other pollutants were detected. Research in the mouth of the canal showed that high concentrations of these substances were also present there, i.e. in the water that flows directly into the river Oka.



The Volosyanikha Canal, at the point where it flows into the river Oka.

This data urged to undertake more thorough research in the course of 1994. In order to prevent any doubt concerning the findings, samples were then analyzed in both Russian and Dutch laboratories. These analyses - taken in 1994 - demonstrated that the level of pollution of the sediments in the Volosyanikha canal was so serious that it greatly exceeded Dutch standards for environmental and health risks. The results pointed towards the necessity to start investigating the extent of possible current sources of pollution and the possibilities of eliminating them. When additional information was obtained the coordination team became convinced that the contamination had also spread into the soil and ground water, within an area considerably larger than the canal itself. It was concluded that any possible clean-up of the sediments of the canal alone would do little to ameliorate the situation.

The pollution in the area near the canal is a direct risk for the local population. Here, in the sanitary protection zone of the factories, several villages are located, in which people pasture their cattle and use the groundwater to irrigate their fields and greenhouses. Besides this, one of the drinking water intakes of the city of Nizhni Novgorod is situated several kilometres downstream of Dzerzhinsk, in the Oka.

The environmental situation in Dzerzhinsk can be compared to the situation in Chapaevsk, a city in the Samara province, where environmental research was also performed within the framework of the project. Data on the pollution of the river Chapaevka, the Otvodnoi canal and the area adjacent to the chemical fertilizers plant of Chapaevsk are of the same order as the data on Dzerzhinsk. In the case of Chapaevsk, however, the Council of Ministers of the Russian Federation approved a Decree 'On the improvement of the ecological situation in Chapaevsk', in April 1993. A programme with measures to improve the ecological situation was adopted, and, according to officials from the Environmental Committee of Samara, it is receiving funding from the federal and the provincial budget. And moreover, the authorities in Chapaevsk had ordered environmental research on chlororganic substances, including dioxins, hexachlorocyclohexane (HCH) and DDT, and possessed the results.

In Dzerzhinsk, on the other hand, public authorities in 1993 could only presume a high level of pollution in the Volosyanikha canal, and did not have any data on pollution from chlororganic substances like PCBs. This was surprising, because, in this city of 300 thousand inhabitants, a number of major chemical plants are concentrated, which formerly produced chemical weapons, pesticides and herbicides, and discharged untreated waste waters into the Volosyanikha canal.

The problem of the pollution of the Volosyanikha canal was selected for the hearing. The main reason for this selection was that it was seen as a very threatening problem. It was a very complex matter and it was thought that a hearing was the best method to address it. At the beginning, however, neither the Russian nor the Dutch people of the coordination team were completely convinced , whether all concerned parties would participate in a hearing, and whether it would achieve the desired result. If the organizing of a hearing had failed, or the hearing had not yielded sufficient results, other steps would have been considered.

2.2 Presentation of the results to all concerned parties

2.2.1 The Environmental Committee of Dzerzhinsk

The research results were discussed with all concerned parties. The Environmental Committee of Dzerzhinsk, as the local department of the Federal Ministry of Environment, was the first to be approached, since this committee is responsible for the environmental control.

During the course of the Volga Project, the coordination team had already contacted the committee many times. It started in 1993, with several visits to the committee, during which, step-by-step, it obtained information on the location of industrial discharges and inspection results. Besides this, the committee offered technical assistance in the execution of environmental analysis.

All samples from the Volosyanikha canal (in both 1993 and 1994) were taken in the presence of an official from the committee. The sampling points coincided with those used by the committee, and the sampling methods prompted no objections. This proved to be very important, because some people later doubted the accuracy of the working methods and the sampling points.

All research results were discussed with the committee. The work was approved because it was conducted in cooperation, and because the analyses were carried out by well known laboratories in Obninsk, Moscow, and Deventer, the Netherlands.

The idea of organizing a hearing was discussed with the committee of Dzerzhinsk, and this committee eventually offered assistance in the preparation. Indeed, cooperation with the Environmental Committee of Dzerzhinsk turned out to be an example of successful cooperation between NGOs and a government body

After this meeting the team identified all other parties with a relation to this problem: business enterprises, and local and regional public authorities. A one month plan of meetings with representatives of almost all of these actors was set up. At each meeting specially prepared set of materials was handed over. This information package contained the research results, Dutch and Russian environmental standards, and Dutch clean-up standards for soil, river bed sediment, and ground water. Besides this, the team developed a special questionnaire to determine the attitude of every concerned party towards the pollution. Lastly, all visited people were invited to the hearing

2.2.2 The business enterprises

The first meeting was arranged with the company Caprolactam - the largest chemical enterprise in the city. In the past this company had produced DDT, and had discharged its waste water into the Volosyanikha canal. The coordination team was received by the manager responsible for Technological and Ecological Safety. The team acquainted him with the Volga Project, presented the research results on the Volosyanikha canal, explained the application of Russian and Dutch standards, and fielded questions. Besides this, the team asked questions following the questionnaire.

The next meetings, with other concerned enterprises, namely Synthez, Orgsteklo, and Aviabor, followed approximately the same scenario. At all these meetings a representative of the city's Environmental Committee was present, which guaranteed the reliability of the information supplied by the plants. And, consequently, it guaranteed the reliability of the information supplied by the Volga Project.

No enterprise possessed comparable data on DDT, PCBs and other chlorine containing compounds, or mercury, neither in waste water samples nor in surface water samples from the Volosyanikha canal. Caprolactam submitted its own data on nutrients in the canal. These coincided with the results of the team's research. The material presented by the project was prepared thoroughly and caused no doubts at any of the plants. All companies agreed upon the existence of the problem. They were forthright in admitting contributing to the pollution in the past and, in some cases, in the present.

After the meetings with Caprolactam and Synthez it became clear that the original plan to organize a public hearing, about the state of the Volosyanikha canal, was feasible. The team estimated that the industry would most probably take part in the hearing, and therefore, during our meetings at Orgsteklo and Aviabor, the team invited these plants to take part. Both plants promised to participate, and the team also called and invited Caprolactam and Synthez. Synthez agreed, Caprolactam too, but only after several telephone calls.

2.2.3 Public authorities

The solution to the problem of the pollution of the Volosyanikha Canal depends heavily on the position of the administration of Dzerzhinsk city, and of the Nizhni Novgorod province. These actors are responsible for a healthy environment in the region, and must develop initiatives to ameliorate the situation They are the only authorities which can effectively pressure other agencies, and industry

The Mayor of Dzerzhinsk and the chief of the ecological department of the administration of Dzerzhinsk said they were not surprised about the research results, and they showed little emotions. Somewhat later, though, the uniqueness of the data was admitted by them, and the Mayor accepted the invitation to participate in the hearing.

Two meetings were held with the province's administration: with the Deputy Governor on Environmental Affairs, and with the Director and his Deputy of the Department on Nature Protection. The Governor Deputy knew nothing about the situation around the Volosyanikha canal. He proposed to include the issue into the provincial governmental programme 'Rebirth of the Volga River'. The Director of the Department on Nature Protection had information on the problem, but initially did not see it as a priority. Nevertheless he promised assistance from his Department in the future. The Deputy Director became interested in the results of the research and considered the problem very urgent.

In addition to these directly responsible authorities, the Committee on Ecology of the Legislative Assembly of the province was visited. It was interested in the issue from a legal point of view. Its chairman proposed to develop a procedural and legal mechanism to solve similar problems in Russia, following the example of the solution of the pollution problems of the Volosyanikha canal.

The presentation of the data on the Volosyanikha canal to the Environmental Committee of the Nizhni Novgorod province, a regional department of the federal Ministry of Environment, was given in the presence of many interested specialists and the chairman of the committee. A lot of questions were asked, and although the specialists of the committee considered it hard to solve the problem, they nevertheless decided to start working on it immediately.

Likewise, meetings were held with the Public Environmental Prosecutor of Dzerzhinsk, the Director of the Federal Programme 'Rebirth of the Volga River', geologists from the centre 'Bowels of the earth' (or: the Environmental and Geological Section of Nizhni Novgorod and Dzerzhinsk), and the head of the administration of Babino, a small village inside Dzerzhinsk.

All these meetings provided additional information that served the preparation of the hearing and further work.

2.2.4 Population

The team also paid a visit to the settlements of Igumnovo and Petryaevka, located close to the canal, and in the sanitary protection zone of the Caprolactam plant. Most of the residents of the settlements were, or are currently, employees at Dzerzhinsk plants. They did not believe in the possibility to change the situation in their region, but listened attentively to the team, and also gave information.

The environmental situation in these settlements is very grave. The drinking water quality is poor, the vegetable gardens located at the bank of the Volosyanikha canal are irrigated, using water from wells which are prohibited for use. The two settlements are not even present on the map: officially they are non-existent, because they are located within the boundaries of the sanitary protection zone and therefore people should not live there. In reality, the people living in these settlements are experiencing hardships. In order to inform the general public, the team attached information letters about the hearing to the doors of shops

2.3 Preparation of the hearing

After all these meetings the date for the hearing was set at 16 December 1994. The Deputy Director of the Department of Nature Protection of the Nizhni Novgorod province was invited to chair the hearing. Mr. Volkov is recognized as a specialist by everyone concerned, understands the seriousness of the problem in Dzerzhinsk, and the importance of a constructive approach to the negotiations by all interested parties.

The coordination team determined two major goals for the hearing:

1. to present, in public, the official point of view of all involved parties, and to present their opinions concerning the priority of the problem of the canal.

2. to present the parties' proposals to solve the problem.

The team decided that it was important to carry out the hearing constructively, without being accusatory towards the plants.

In cooperation with the chairman, the programme of the hearing, and a draft 'Letter of Intent' to coordinate activities directed at cleaning up the area around the Volosyanikha Canal were prepared. Official invitations were sent to the people previously visited, and to the provincial Sanitary and Epidemiological Agency, the Hydrometeorlogical Agency, and the Committee on Land Resources.

To guarantee the quality of the arguments of all parties and the objective discussion of the problem, it was thought important to invite the independent specialists working within the Volga Project - Tatiana Shpotova and Marina Adas - and besides them another, external, expert from Moscow - the chemist Sergei Yufit from the Academy of Sciences.

The Volgograd Green Movement, the Ecological Club 'Green Branch' of Yaroslavl and the Ecological Club of Cherepovets, were also invited. These three organizations are participants in the environmental network of NGOs in the Volga river basin, *Let's help the River*.

2.4 The hearing

The hearing took place in the town hall of Dzerzhinsk, and was arranged by the city administration, which also assisted in the on-site organization. All of the invited enterprises, agencies, and organizations took part in the hearing, and around 60 persons were present.

The hearing followed the following programme:

- A brief presentation of the research results on the Volosyanikha canal obtained by the Volga Project, and a short explanation of the proposals of the Volga project for the solution of the problem.

- Comments on the research results and proposals to eliminate the pollution from the business enterprises, the public authorities, representatives of the programme 'Rebirth of the Volga', and independent experts.

- Discussion on, and signing of, the Letter of Intent.

A set of materials, prepared by the coordination team, was distributed with a brief description of the problem of the Volosyanikha canal, an overview of the research results of 1993 and 1994, information on the main pollutants, and the draft Letter of Intent.

At the hearing, the coordination team of the Volga Project proposed the following step-by-step action plan to solve the problems of the Volosyanikha canal:

Stage I
- Collect, and carry out an inventory of all available data on the pollution of the area around the Volosyanikha canal and on the sources of pollution

Stage II
- Perform supplementary research on the contamination of the soil, and on the ground water in the canal area.
- Take measures to eliminate the sources of pollution of the soil and the water in the area of the canal.

Stage III
- Cleaning up of the territory around the canal.

The representatives of the Volga Project put forward several important issues:

- the research should be conducted openly, and information should be available for the local population, environmental organizations, and other interested parties.

- an inventory of the sources of pollution should be started immediately, and any further spreading of the pollution should be prevented as soon as possible.

- a working group, on the solution to the problem, should be created, which should also include representatives from the environmental movement

All parties, without exception, officially confirmed the point of view which they had voiced at their preliminary meeting with the coordination team. All parties considered the problem important, and the majority of the participants acknowledged the necessity to take urgent measures. Not all enterprises were forthright about their own present contribution to the problem, but the independent experts, in their comments, pointed out facts which made it impossible for the business enterprises to deny their share of responsibility for the problem.

2.5 Results

2.5.1 Letter of Intent

After discussion and corrections, the Letter of Intent was signed by all concerned parties, except for the Synthez, Caprolactam and Aviabor companies, which delayed signing until discussion with their respective managements. In the letter, parties promised: I) to prevent additional pollution from entering the canal, and its surroundings; II) to prevent further pollution of the soil and groundwater; III) to look for material and financial resources to clean up the territory around the canal (See Appendix I).

The Synthez and Aviabor companies signed the Letter of Intent a few days later, 21 December 1994 at the Department of Nature Protection of the Nizhni Novgorod province. Caprolactam did not sign the protocol, but accepted the first two of the three obligations in a letter which was signed by the plant's management (see Appendix I).

2.5.2 Working group

Time, of course, had to show whether the signing of the Letter of Intent was really taken seriously. It soon turned out that the concerned parties were not avoiding their

responsibilities: at a following meeting, which took place one month later, a working group was created in which all parties were represented, including representatives of the environmental movement. This working group now meets once each month in Dzerzhinsk and is developing a working plan to improve the environmental situation around the Volosyanikha canal.

Of course, the participants realize that cleaning up the territory is far beyond their present capabilities. They have, however, decided to gather all the existing information on the pollution of the territory around the canal, and to focus first on the elimination of existing pollution sources, in particular on chemical waste dump-sites, production sites, and on the huge `settling pond' belonging to Caprolactam, which is leaking. Also, more research is scheduled for 1995.

The coordination team will continue to participate in this working group. The environmental movement acts as the conscience and the engine of the working-group, and continuously motivates the others members. In addition, it has an important role as an information source, because of its connections with the Netherlands.

2.5.3 Stimulus for local science

A positive side-effect from the hearing is its stimulation of local science. Geologists from Dzerzhinsk had been performing observations in Dzerzhinsk for several decades, but until now their data was not being put to practical use. This information is now indispensable for a good insight into the behaviour of pollutants in the area around the canal. Furthermore, as a result of the attention on Dzerzhinsk by the Volga Project, the local environmental laboratory is increasing its analytical capabilities for pollutants, such as PCBs.

The chemist Sergei Yufit from Moscow, who participated in the hearing, included the city of Dzerzhinsk in his scientific programme `Dioxins in human milk'. Within this programme one sample of human milk of several mothers in Dzerzhinsk will be analyzed on the presence of dioxins. The results, including recommendations for feeding babies in Dzerzhinsk, will be presented to the citizens of the city.

2.6 Conclusions

The hearing in Dzerzhinsk has demonstrated the possibilities for public participation, in a discussion with all concerned parties, on an environmental problem. This was the first time in Russia that such a hearing was conducted by an NGO. For the first time ever, in Dzerzhinsk, all the concerned parties together discussed the problem of the Volosyanikha canal, and negotiated as equals. The hearing took place in a constructive atmosphere without conflicts. It has proven to be a good working method.

Public authorities often proved quite willing to cooperate with environmental NGO's, supplying them with information, and listening to proposals aimed at the amelioration of the situation. It was very interesting to note that industries were also willing to talk to representatives of environmental organizations. These were both factors, vital for the success of the hearing.

On the other hand, it was often difficult to obtain information. It took time before trust was built between the parties. Sometimes governmental agencies asked money for their information. If, however, in such case the NGO had something to offer in return - for example results of own research, or important technical information - the agencies usually got very interested, and did not mention money any more.

In addition, important information was sometimes simply lacking. For example, the extensive pollution of the Volosyanikha canal in Dzerzhinsk was not documented well, and especially lacking are evaluations of the situation in relation to standards, and techniques to diminish pollution.

It was important that the coordination team could continuously supply itself with information from the Netherlands.

The whole process has also shown that good preparation and presentation of research results, were important factors for success.

The environmental organizations which participated in the hearing said that it had inspired them. However, they also made it clear that a hearing might not be successful everywhere, since local situations greatly differ. They also pointed to the fact that Nizhni Novgorod province is very much ahead of other regions in political and democratic terms. Nevertheless, the environmental organizations are now trying to adapt this working method in their own region. Their participation in the Volga Project is described in the following chapter.

CHAPTER 3.

PARTICIPATION OF ENVIRONMENTAL NGOS OF THE VOLGA REGION IN THE PROJECT

3.1 Introduction

Along the Volga in each city at least one, but often several environmental organizations are active. Usually 5-10 active members are involved in the organization, and several tens (or even hundreds) of sympathizers participate in actions. Most of the organizations consist entirely of volunteers.

The Volga NGOs operated separately from each other, until October 1990, when the organizations *Ecocentre Dront* and *Zeleny Mir* in Nizhni Novgorod took the initiative to organize the conference 'Days of the Volga 1990'. Several tens of activists from all over the Volga region used the occasion to exchange experience in fighting their respective local environmental problems.

During the second 'Days of the Volga', in 1991, the NGOs that were present developed an action programme *Let's help the River*, a long term non governmental action programme for the protection and salvation of the Volga river basin. The goals of the programme are: to draw public attention to the environmental problems of the Volga river basin; to encourage the development of an environmental protection policy in the Volga river basin; and to implement campaigns, directed at the protection and the salvation of the Volga river. At the same time, the organizations established a coordination centre of the programme in Nizhni Novgorod. Its task is to coordinate the activities of the affiliated environmental NGOs, and to realize the annual programme of *Let's help the River*. Since then, *Let's help the River* has grown into a network of environmental NGOs along the Volga in which approximately 30 organizations participate, that are active in different fields (See 3.2).

This is a major achievement. Since the collapse of the Soviet Union, Russian environmental NGOs had to adapt to the new circumstances in a very short period of time. Due to the poor economic situation, they can now hardly apply for funding at their government any more. Many Russian organizations are dependent of Western funds. Although a lot of NGOs in the bigger cities have been well equipped with computers, printers and modems, which has much improved communication between them, there is still a gap between the level of development of organizations in the major cities and those in smaller ones.

Milieukontakt Oost-Europa heartily supports activities like *Let's help the River*, in which organizations themselves take the initiative to ameliorate the situation After two years of contacts between Milieukontakt and the coordination centre of *Let's help the River*, it was decided to start a special joint project directed at environmental organizations that combat the industrial pollution in the Volga river basin. The organizations in the Volga basin had little practice with strategic, long-term, action planning in this field, and thus the experience built up by the Dutch environmental movement during the past 25 years, was thought to be of use.

Other themes within *Let's help the River* stayed beyond the scope of the Volga Project. Environmental education, for example, was already supported within the regular work of Milieukontakt. In the field of chemical weapons Russian

organizations had already built up tight contacts with, especially, American colleagues. Other causes of pollution of the Volga river, such as agriculture, would ask for a different approach and were therefor not addressed within the Volga Project.

The final aim of the Volga Project was to contribute to the strengthening and professionalization of the environmental movement in the region. It was the first time that Milieukontakt participated that actively in an action-campaign. This was considered important in order to be able to continuously offer Dutch experience. It implied that the Dutch coordinator of the project was based at the Volga. During these two years, Milieukontakt, on the other hand, also learned very much about the environmental movement in the Volga region.

Within the Volga Project, Milieukontakt Oost-Europa cooperated with the coordination centre of *Let's help the River* and local environmental organizations. This chapter presents the Russian partners of the project, describes how cooperation with local environmental NGOs along the Volga has been built up, and what the Volga Project means for them.

3.2 Let's help the River

Starting in 1991, *Let's help the River* created a network of environmental groups in the Volga river basin, and coordinated the activities of these groups. This network is continuously extending Within the programme several campaigns, actions and happenings were carried out, like for example:

- A campaign against the rise of the water level of the Cheboksary water reservoir. As a result of the action, the rise of the water level was halted,
- An action - within the framework of a campaign - against 'explosion mining' in the 'Samarskaya Luka' national park, in Samara province. As a result, explosions were stopped for one month,
- The 'Rock for Clear Water 1992' boat tour along the Volga. As a result of this tour, new environmental groups appeared, and firm contacts with scientists were established;

Moreover, *Let's help the River*:

- established an independent newspaper for environmental organizations from the Volga river basin in Nizhni Novgorod. The paper, called *Bereginya*, is being distributed in the Volga river basin, and around 30 issues have so far appeared;
- established seven environmental education centres for children in cities along the Volga;
- created a consulting point and laboratory for the environmental movement organizations in the Volga river basin;
- established working groups on the problems of water reservoirs, energy, and biodiversity conservation;
- founded the Alliance for Chemical Safety;
- implements the following projects: the Russian-Dutch Volga Project, a 'Drinking Water project', and the 'Public Environmental Monitoring project';
- organized five 'Days of the Volga' conferences and a conference 'The Future of the Cheboksary Water Reservoir'.

3.3 Cooperation with local environmental NGOs

Cooperation with local NGOs was sought at an early stage of the project, which began by sending a questionnaire to a number of relevant organizations in the Volga river basin area. The questionnaire requested information on the most pressing local environmental problems, the possible threat these posed to the river Volga, and the extent to which NGOs would be interested in participating the Volga Project. The response to this questionnaire was rather low. But particularly at 'Days of the Volga 1993', at the workshop on the Volga Project, where the preliminary research results and plans for the Project's next year were presented, representatives of several environmental organizations expressed their interest to participate in the Volga Project.

To determine the form which cooperation might take, the coordination team visited a number of local organizations in the cities of Volgograd, Yaroslavl, Nizhni Novgorod, Kstovo, Novokuibyshevsk, Kazan, Perm, Cherepovets and Samara. In general these visits took several days. The organizations were informed about the progress of the Volga Project, and the coordination team received information about the activities, successes and problems of the local NGO. A visit to the polluted area formed part of these visits, in order to get an idea of the nature of the pollution which would be addressed by the project. Together with the local organizations it was explored how participation in the Volga Project could strengthen local action, for example through research. It was decided that local organizations would select one problem and carry out a campaign to ameliorate the situation. Important criteria in selecting a problem were:

- Intensity of pollution
- Risk of pollution for public health and for the environment.
- Explicit neglect of environmental law.
- Absence and non fulfilment of environmental measures to stop the pollution.

The working method, as proposed by the Volga Project, was discussed by the visited organizations. Three of them could agree with the set-up of the project and thought it was feasible: the *Volgograd Green Movement* in Volgograd, the ecological club *Green Branch* in Yaroslavl and the *Ecological Club Cherepovets* in the city of Cherepovets. They are all member organizations of the network of *Let's help the River*.

The fourth group is the coordination team of the Volga Project itself, which covers the Nizhni Novgorod region. By acting as a local organization itself, gaining its own campaigning experience, the team was better able to assist other groups in the implementation of their campaigns.

Though this might seem a small number of NGOs, one should keep in mind, that all these organizations consist entirely of volunteers, and combating industrial pollution in a country with such a poor economic situation, is a heavy task. Some activists do not want to deal with this task, in fear of reprisals.

In Volgograd and Yaroslavl local sampling campaigns were executed in close cooperation with the local NGOs, which prepared a general overview of the situation. Priorities were set by the coordination team together with these local NGOs. Samples of surface water and bottom sediments were analyzed to get a picture of the condition of the Volga river, both upstream and downstream of these cities. Besides this, some major sources of pollution of the Volga river and its tributaries were researched. In the city of Cherepovets only one sample was taken: it proved impossible to complete additional sampling, due to the onset of the 1994-95 winter.

On the basis of the research results, the participating organizations chose a case study to focus on. The *Volgograd Green Movement* decided to work on the solution of the problem of soil contaminated with mercury by the Caustic plant, located in the Krasnoarmiya district of the city. *Green Branch* in Yaroslavl decided to focus on the Lakokraska factory, which is suspected to be responsible for some illegal discharges of waste water into the Volga river. In Cherepovets the metallurgical plant Severstal had, for several years, already been the main focus for *Ecological club Cherepovets*. The coordination team of the Volga Project chose a heavily polluted canal in the industrial city of Dzerzhinsk (See chapter 2).

3.4 Significance of the Volga Project for local NGOs

3.4.1 Support of local actions

The participating organizations are in different stages of development and are working on their own particular pollution case, so they are assisted on an individual basis. The coordination team functions as adviser for the local NGOs. It keeps continuous contact with the organizations, and regularly visits them. It provides them with all kinds of information and documentation. Groups were informed by the coordination team about subjects like:

- Governmental water management (who is in charge of what?)
- Pollutants, such as PCBs.
- Technical processes (including information from foreign sources).
- Dutch and Russian environmental standards for water and sediments.
- How to take water and sediment samples.
- How to build up a file on a case of pollution (exactly what information is needed?)
- How to prepare a hearing.

3.4.2 Strengthening of cooperation

In total, three meetings between the coordination team and local NGOs were organized - attended in each case by representatives of all relevant organizations. Aim of the meetings was to encourage cooperation between the participating organizations. In 1994 the organizations met twice in Nizhni Novgorod: after the 'Days of the Volga-94' in October, and after the hearing in December. In October they discussed various ways of approaching local environmental problems, and evaluated the support offered by the project coordination team. In December the usefulness, and applicability in other situations, of the hearings was discussed. In February 1995 the organizations met in Cherepovets, where they kept each other informed about their activities and discussed, in detail, the specific problems of the *Ecological Club Cherepovets*.

During the meetings the topic of a regional approach to problem solving was also touched upon. The aim is to develop strong cooperation between organizations throughout the whole Volga region, that are capable of influencing polluters. This will be further elaborated in a regional campaign on industrial waste, in Winter 1995, within the 'Strategic Action Planning' project of Milieukontakt's Project Russia and Ukraine.

3.4.3 Material support

Within the project it was also possible to materially support organizations. Three organizations received a computer, printer, modem, and financial support for overheads. These were: the Volgograd Branch of the *Committee for the Salvation of the Volga*, *Green Branch* from Yaroslavl, and the ecological centre *Green House* in Cheboksary. In addition, the *Ecological Club Cherepovets* received money for overhead expenses.

Also, the Volga Project acted as an intermediary for *Ecological Club Cherepovets* to find funds for a printer and a xerox machine, at the *Small Embassy project* of the Dutch Embassy in Moscow and the *Small Grants Fund* of Milieukontakt. This allowed the Club to begin producing a regional environmental newspaper. The Volga Project also acted as an intermediary for the *Volgograd Green Movement* With money, again, from the Dutch Embassy and Milieukontakt, the movement started the organization of a hearing.

3.4.4 Evaluation

The local organizations participating in the Volga Project have indicated that the project has been valuable for them in several ways. It was important for them to have had the possibility to conduct independent research, and to be able to consult the coordination team and the scientists who are involved in the research. Moral support and genuine interest in the local situation, from outsiders, are both mentioned by the local organizations as being very important.

The hearing in Dzerzhinsk, where all the participating organizations were present, was seen as a valuable strategy, and as a promising beginning to address the problem. The organizations are now adapting and introducing this working method in their own region.

3.4.5 Strengthening of the local NGOs

During the course of the project, organizations expressed their interest in information and trainings which would contribute to the improvement of their internal structure and to their skills in strategic action planning.

Four representatives of the environmental movement along the Volga participated in a study visit on strategic action planning to the Netherlands in May, 1995, organized by the Milieukontakt's Project Russia and Ukraine.

The 'Organization and Management Project' of Milieukontakt will focus its activities on the Volga region in 1996.

3.5 Description of the participating local NGOs

3.5.1. The Volgograd Green Movement

The *Volgograd Green Movement* is a non-governmental organization, which was founded on 10 November 1993. It is made up of two experienced and effectively working organizations: *Ecologia*, and the Volgograd branch of the *Committee for the Salvation of the Volga*. They have substantial memberships of their own and meet separately once a week.

The chairman of the *Volgograd Green Movement* is Robert Petrov. Around 15 people actively participate in the activities of the movement. These people have different backgrounds: they are teachers, doctors, engineers, and financial workers. They meet together once a month.

The object of the Movement's activities are the environmental problems of the city of Volgograd, that are encountered by means of actions directed at the public, and by lobby activities towards the governmental structures. Besides this, the Movements works in the field of environmental education.

As a result of the organization's activities in the past the construction of the 'Volga-Don' canal was stopped, the building of a bazudine producing plant was prevented, the commissioning of the Rostov Nuclear Power Plant was halted, and a municipal ecological centre (a high school) was opened.
Public support for the organizations in Volgograd is strong. For example, at June 5, 1994, World Environmental Day, approximately 300 people visited the open air environmental festival in the Krasnoarmiya part of the city, organized by *Ecologia*.

The organization joined the Volga Project in January 1994. At the end of August, research of surface water and bottom sediments in the city was carried out. Besides this, samples were taken from the settling pond of two chemical plants - Caustic and Khimprom in the Krasnoarmiya district, and also of soil around the Caustic plant. On the basis of the results of this research the organization decided to focus its activities on the dangerously high mercury contamination of a vast area of the Krasnoarmiya district, which was caused by the Caustic plant. The aim of the *Volgograd Green Movement* is to influence the policy of local authorities in order to replace the polluting technology of mercury electrolysis, used in the production of caustic and chlorine, by a mercury free technology, and to possibly clean-up the polluted area. It aims to reach this goal by organizing a public hearing.

In preparation for their hearing, over a period of several months, the *Volgograd Green Movement* will take additional samples of soil, in the area around the plant, to determine the seriousness and extent of the mercury contamination. Besides this, they will organize negotiations with the plant's management, with the Environmental Committees of the district and the city, with the Sanitary and Epidemiological Agency, and with the public authorities of the district and of the city. The additional sampling has started, and several soil samples have already been analyzed. Contacts with local authorities and institutions have been made, and first negotiations have taken place

3.5.2 Ecological club Green Branch in Yaroslavl

Green Branch is a non-governmental organization, which was founded in July 1988. For 7 years, Lidia Baikova has been the group's chairperson. *Green Branch* has 32 activists participating in the club, with a nucleus of five active people. It consists of people with various occupations: biologists, geologists, hydrologists, teachers, and doctors. They meet once a week.

The organization focuses on the environmental situation in the whole Yaroslavl province, but also participate in activities that go beyond the provincial borders. It tries to ameliorate the situation by means of public environmental monitoring, lobby activities towards the local government, and legal actions, including law suits. Besides, they work in the field of environmental education.

The organization has contributed to the cessation of plans for the construction of a Heat and Power generation plant, and the construction of the third stage of the city's water treatment facility. It has, for example, won its first law suit (on behalf of a private person), with technical support of students, in a case of "noise pollution".

Green Branch joined the Volga Project in 1994. In the summer of the same year surface water and bottom sediments within the city borders were analyzed, and samples of waste water and bottom sediments near discharges of some major plants were taken. On the basis of the results, *Green Branch* selected the Lakokraska plant as the subject for its case study. This was because the central drinking water intake in the Volga is located downstream of Lakokraska, and its discharges influence water quality. The aim of the activities on the

Lakokraska plant is to eliminate unauthorized discharges from the plant into the Volga river and to prevent toxic wastes from the production site of the factory from entering the Volga river. The organization plans to achieve this by organizing a round table conference in Summer/Fall 1995. In preparation for this round table the organization will collect technical information on the factory, organize meetings with the leadership of the plant, and publicize data about pollution caused by the plant in the media. It plans to carry out some additional research in Summer 1995. Some technical documentation on the plant - including licences - has already been obtained, and several publications and appearances in the media have been made.

Yuri Vanzha of *Ecoclub Cherepovets* en Yevgenia Kvakina of *Volgograd Green Movement*

3.5.3 Ecological Club Cherepovets

The *Ecological club Cherepovets* is a non governmental organization which was founded in June 1988. Yuri Vanzha and Samuil Fonbershtein are its co-chairmen. The Ecological Club has more than 30 continuous members, among them doctors, engineers, teachers, cultural workers, pensioners, and manual workers. The nucleus of the Club consists of 12 active members The club meets on a weekly basis.

Its activities cover the environmental situation of the city of Cherepovets and the vicinity. Of special concern is the very high level of pollution in the city, caused by the local giant steelmaking enterprise. With its activities the Club wants to increase pressure on the metallurgic factory, so that it will diminish its pollution. Therefore *Ecoclub Cherepovets* performs legal actions, and develops lobbying activities towards the local government.

As a result of the Club's activities in the past a number of decrees were adopted by municipal, provincial and federal agencies on the improvement of local environmental conditions, and a department of environmental protection was established within the municipal administration. Several times environmental information was obtained through the intervention of courts of law. Recently, *Ecoclub Cherepovets* has started a series of legal steps to clarify the status of the sanitary protection zone of the metallurgic factory.

Ecoclub Cherepovets joined the Volga Project in September 1994. The subject selected was the discharges of the metallurgical plant, that flow into the Rybinsk water reservoir. The aim of the activities within the Volga Project is to decrease the discharges of waste water from the metallurgical plant, thereby improving the condition of the Rybinsk water reservoir within the Cherepovets region. The organization has already collected and processed data on the pollution of the Rybinsk water reservoir and its tributaries. Independent research would be an important addition to this information.

3.6 Conclusions

The approach of combating the industrial pollution of the river Volga, as proposed by the Volga Project, is considered valuable by Russian NGOs As a result of the project three local organizations, consisting entirely of volunteers, and the project's coordination team, started to deal with their local environmental case.

The participating organizations gained experience in carrying out independent research, and in interpreting research results. They also learned how to choose case studies, and how to develop an action plan. Actions to reduce the industrial pollution of the Volga basin have been set up by them and are proceeding well.

Through the Volga Project, the participating organizations learned the importance of integrating their activities in an overall strategy, in which research is not an end in itself, but part of the strategy.

The involved NGOs are interested in setting up strong regional cooperation between organizations throughout the whole Volga region, that are capable of influencing polluters. This topic will be further elaborated during a regional campaign on settling ponds in Winter, 1995.

Furthermore, organizations' representatives attended the public hearing which was organized by the coordination team. The representatives viewed the public hearing as a useful method of addressing an environmental problem They will adapt and introduce this experience in their local situation

The project also yielded valuable information on the needs of NGOs in the Volga basin, and on the various factors hampering their progress. The organizations from the Volga basin made it clear that they are in need of information and trainings in organization and management skills, and in strategic action planning Therefore, four representatives of the environmental movement along the Volga participated in a study visit on strategic action planning to the Netherlands in May, 1995.
And Milieukontakt's 'Organization and Management Project' will focus its activities on the Volga region in 1996.

It is expected that with these experiences organizations are able to increase their influence on the environmental policy making process in their respective regions.

CHAPTER 4.

ENVIRONMENTAL RESEARCH

4.1 Introduction

In order to be able to organize and execute a complicated action, like the one envisaged in the Volga Project, a good understanding of the environmental situation was needed. This understanding could be gathered only by research into the pollution of the river Volga. It was needed to assist *Let's help the River* determine the urgency of actions to ameliorate the water quality of the Volga, and to set priorities for its activities. Furthermore, sufficiently detailed information was needed to be able to carry out concrete actions to ameliorate the situation.

Thus, three major objectives for the research work could be defined:

1. Obtain a general impression about the chemical quality of the river Volga.
2. Identify major sources of pollution.
3. Obtain sufficiently detailed information about a limited number of sources of pollution to be able to call attention to the problem.

This chapter will contain a general description of the methods used in this research and an evaluation of the results.

4.2 Methods of research

4.2.1 Introduction

Research in the framework of the Volga Project consisted predominantly of preparatory research and field work. Research was limited to the chemical quality of surface and waste water and sediments, and focused on industrial pollution. This was because in this field much experience already exists in Western Europe, where an extensive system of environmental standards has been developed, offering a solid base for the evaluation of findings

Preparatory research consisted of several elements. From the general literature it was possible to get an overall impression of the most important economic activities in the basin of the river Volga, and the places where major industries were settled. Next to this it was important to obtain existing results of environmental research, from as many agencies as possible. This data was mainly compiled by government agencies that, as part of their duties, regularly monitor surface water quality and industrial discharges. Their findings are public. Also, discharge permits and overviews of quantities of polluting substances discharged were studied. Finally, it was important to decide upon a set of environmental standards with which to compare findings.

A study of this material showed which information should be added by fieldwork. The team was especially interested in information about important pollutants like (polychlorinated biphenyls (PCBs), mercury, cadmium and polycylic aromatic hydrocarbons (PAHs), and in information about sediment quality. Another important reason for undertaking fieldwork was to be able to dispose of the teams

own data in comparison with, and, if necessary, opposition to, government data. Experience in Western Europe showed that sampling by NGOs often yielded much information that could not be obtained from government sources.

Fieldwork consisted of taking samples of surface water, (industrial) waste water and sediments. These samples were analyzed to determine the content of a number of substances. In order to evaluate the results of these sampling campaigns, the concentrations of contaminants found in the samples were compared to environmental standards that are in use in Russia and in the Netherlands.

4.2.2 Sampling campaigns

In the course of 1993 and 1994 several sampling campaigns took place. The work was carried out in two stages, the first of these in 1993, and the second in 1994. The exclusive objective during the first stage was to obtain reliable background information about the general level of pollution of the river Volga, and to identify some important sources of pollution along the river. In the second stage the focus was on gaining a deeper understanding of the situation with regard to a limited number of already selected sources of pollution.

The samples were taken by Marina Adas from Geocentre in Moscow, who took all the sediment samples, and Tatiana Shpotova, from the Centre for Environmental Research in Obninsk, who took all the water samples. They also took care of conservation of samples and in transport to the Russian laboratories for analysis. From *Let's help the River*, Yelena Kolpakova took part in both the preparatory research and in the sampling campaigns. From Milieukontakt Oost-Europa Itske Lulof and Joost Rutteman took part in both the preparatory research and the sampling campaigns. In the preparation and execution of the sampling campaigns use was made of experience in this field from Dutch NGOs, notably the *Reinwater Foundation*, which had organized similar sampling campaigns on the rivers Rhine, Meuse and Scheldt.

In addition to this permanent sampling team, experts from government agencies took part several times in the sampling: most notably those from the city committees for nature protection in Nizhni Novgorod and Dzerzhinsk. Shipping, transport and materials for sampling were provided by the State Committee on Geology in Moscow, Hydromet in Nizhni Novgorod, Hydromet in Samara, Hydromet in Volgograd, the Fleet of Young Seamen of the administration of Yaroslavl, the provincial committee for nature protection of Nizhni Novgorod and Samara, and the city committees for nature protection of Nizhni Novgorod, Dzerzhinsk, Kstovo, Volodarsk, Pavlovo and Chapaevsk.

All samples were analyzed in independent laboratories in Russia. A limited number of samples were also transported to the Netherlands and were analyzed in a Dutch laboratory. An overview of methods used to analyze the samples can be supplied upon request.

During the first stage of field-work, in the summer period of 1993, extensive sampling took place in two provinces. The research activities were thus geographically limited for several reasons. Firstly, the enormous size of the Volga basin forbade a sampling campaign covering the whole basin. Limiting sampling of the area of two provinces was a much more realistic target, the average size of one oblast in European Russia being comparable to Benelux. Also, there was little or no NGO experience in organizing sampling campaigns in Russia. Therefore it was difficult to predict any of the particular problems which would arise during the sampling campaign. In preparing the sampling campaigns it was, therefore, also taken into account that drastic adaptations of the sampling program might prove necessary, and that there might be delays. In the two provinces chosen as a site for the first stage of the field-work, Nizhni Novgorod and Samara, a huge array of industries can be found: chemical, petrochemical, pulp and paper, machine and automobile industries, and aircraft construction. Industrial activity and population are of roughly the same size in both provinces.

Water sampling in Samara, 1993

During the second stage of the research, in the summer and autumn of 1994, a more thorough examination took place of several preselected sources of pollution. Some of these had been identified during the research campaign of 1993, while the others were included in the program because of information from local environmental NGOs. Factors that determined the sampling campaigns in 1994 were the presence of a suspected or known source of pollution and the willingness of local NGOs to deal with the situation. So field work in 1994 was directed at several problems in the Nizhni Novgorod province and the cities of Yaroslavl and Volgograd. In Yaroslavl and Volgograd - where no research took place in the course of 1993 - some samples were taken to get an impression of the local level of pollution of the Volga, in addition to the research directed at the predetermined sources of pollution.

4.2.3 Choice of locations for sampling

Samples were taken at locations that were expected to yield an impression of the general quality of surface water and sediments, and at locations that would show the influence of local industrial activities. Furthermore, in principle, samples were taken at all known discharges of waste- and sewage water. Surface water was taken both from the main stream of the Volga, and from tributaries - if there was reason for concern due to local industrial activities. With regard to industrial waste water it was in fact only possible to sample pure waste water discharges in a few cases. This was because most industrial waste water is treated in central treatment facilities, together with sewage water. It was, however, often possible to take samples of drainage water coming directly from production sites. In 1994, as it became clear that these were important sources of pollution, samples were also taken in settling ponds.

An important feature of the sampling campaigns in 1993 and 1994, that was new for Russia, was the research of bottom sediments. Many of the most important pollutants in surface water readily attach themselves to small suspended particles, that are always present in surface water. This suspended matter plays a very important role in determining the behaviour of these pollutants In places where the water current is slow these particles tend to settle as bottom sediment. So pollutants can remain in the river system for a long period of time. The quality of these sediments is an important indicator of the general environmental situation and the spreading of pollution. Therefore, the examination of bottom sediments is often at least as important as that of surface water. In the Netherlands, for example in the monitoring of the environmental condition of the rivers Rhine and Meuse, with regard to many pollutants, public authorities no longer examine the quality of the water itself but that of the suspended matter that is transported with it.

Sediment samples were taken on locations that were selected in order to obtain a general picture of the level of pollution in the larger rivers, lakes and canals. Sediment samples were also taken in the immediate vicinity of waste and drainage water discharges, in order to obtain an impression of the substances discharged there. In the major rivers Oka and Volga themselves sediment often proved hard to find: due to the velocity of the current the smallest particles - with polluting substances attached - cannot settle there, and often only sand could be found during sampling. Therefore, in order to get a picture of the general level of pollution in the river Volga itself, sediment samples were taken in the Kuibyshev water reservoir. This reservoir is formed by a dam at Togliatti, just upstream from Samara. The reservoir is thus located downstream from the industrial centres Nizhni Novgorod, Cheboksary and Kazan. In the reservoir the velocity of the current is much reduced, allowing small particles to settle, and it was therefore possible to take sediment samples there. Originally it was planned to take samples in the Cheboksary reservoir too. This reservoir is located immediately upstream from the Kuibyshev reservoir, and downstream from Nizhni Novgorod. Due to bad weather conditions it was impossible to take these samples.

4.2.4 Substances analyzed

The focus of the research covered those substances included in the so called 'blacklist' of substances considered (extremely) harmful to the aquatic environment, which was issued by the European Commission in 1983 (EC, 1983). This list still forms the basis of water quality management throughout the European Union. A complete list of analyzed substances can be found in Appendix II, Table 4.1.

Monitoring of these substances may be expected to give an indication of the environmental situation in the river and of the effects of human activities. In the rivers Rhine, Meuse and Scheldt the presence of these substances is routinely monitored by several agencies - such as Dutch and Belgian public authorities, and drinking water companies. Yet the chemical picture should not be considered a complete picture of pollution: even if a much wider array of substances is analyzed in water from the river Rhine, the presence of identified substances only explains about 15% of detected toxicity.

A complete analysis was made only of those samples that were expected to represent the background situation. In analyzing the other samples a selection was made depending on the substances expected at that particular location.

4.2.5 Water and sediment quality standards

In order to evaluate them, the findings of the sampling campaigns were compared to both Russian and Dutch surface water standards and sediment quality standards. A summary of these standards can be found in Appendix II, Tables 4.2 and 4.3.

In Russia two sets of standards for water quality exist. The allowable limit concentrations (in Russian: PDK) for fish water (PDK-f) (Committee on Fishery, 1993) and sanitary standards for water quality (PDK-s) (Ministry of Health, 1991). Fish water quality standards have been set for about 1600 individual substances, thus making the Russian standards for water quality very complete. Though the number of substances included in the sanitary standards is less than that included in the standards for fish water quality it is still substantial.

There is no comparably thorough and authoritative set of Russian standards for the quality of sediments, though for some substances unofficial standards have been elaborated. This lack of standards for the evaluation of the quality of sediments means that, in Russia, only very little research work has been done in this field, as it is impossible to evaluate the results of such research.

The Dutch standards for water and sediment quality are those issued by the Dutch government in 1991 for the purpose of judging the environmental quality of water, sediments and soils. These standards comprise a much smaller number of substances than those set in Russia (about 120, roughly covering the 'classical' pollutants, plus the European list of 129 dangerous substances), but they have been elaborated for both water and sediment quality.

4.2.6 Comparison of research data to environmental standards

All water samples have been compared to the Russian standards for fish water. If there was a more severe sanitary standard for water quality then this was used. This was for example done with regard to cadmium and lead. If there was no Russian PDK, the samples have been compared to the Dutch standard The results of the analyses of the water samples are presented in Appendix II, Tables 4.4-4.21.

It is important to note here that concentrations of pollutants in surface water, and in discharges of waste water, can only be seen as an indication of pollution. In order to estimate the importance of water pollution it is necessary to calculate quantities of polluting substances that are introduced into the environment and transported.

In general the following qualifications can be given in comparing the actually found concentrations to environmental standards. In Russia the quality of surface water should be in accordance with the standards for either fish water or the sanitary standard (allowable limit concentration, in Russian: PDK). So if the water quality does not agree with the PDK standard then the situation is - in principle - unacceptable.

This system is somewhat different from that used in the Netherlands where - in addition to the standards for desired environmental quality - `policy values' exist for the period until the year 2000. These policy values guide the activities of public authorities that are responsible for water quality management. If these values are exceeded then there is reason for concern. In order not to unnecessarily complicate the standards presented in this report only the Dutch desired environmental quality standards are presented. In general, with regard to the substances that were included in this research, the Dutch 'policy' values do not differ greatly (more than a factor 2-3) from the values for desired quality. Also the Dutch standards do not differ very much from the Russian standards, and are in several cases much more severe. So it can be taken as a rule of thumb that if concentrations are found in surface water that substantially exceed the PDK values, then a serious problem exists. This is especially so if in the main stream of the Volga river and major tributaries, like the Oka river, an elevated concentration of pollutants is found. High concentrations in small tributaries or in a discharge of waste water are of course also undesirable, but further research is needed to quantify this pollution. This was not done systematically during these research campaigns.

High concentrations of pollutants in sediments may point to the existence of a source of pollution, but may also reflect a problem that existed in the past. In order to assess the effect of pollution in both present and past, and to establish the need for action to ameliorate the situation, the quality of sediments is an important indicator, but it should be supplemented by other research to quantify present day sources of pollution. Of course the poor quality of sediments can also pose a problem in itself. Polluted sediment is hazardous for organisms living at the bottom of rivers, and can again pollute surface water through resuspension of sediments or through release of pollutants from sediments, depending on their chemical properties

In judging the quality of sediments during the 1993 research, a Russian method was used, in which a calculation was made using the substances whose concentrations surpass the environmental standards. If the SPZ value is smaller than 8 then there is only a small amount of pollution. If it is between 8 and 16 then there is an acceptable level of pollution, between 16 and 32 a moderately dangerous level of pollution, between 32 and 128 a dangerous level of pollution. When the SPZ is greater than 128 then the level of pollution is extremely dangerous. The symbol SPZ1 is used to indicate heavy metals, for the assessment of ammonium nitrogen, nitrates, phenols and oil products the symbol SPZ2. For chlororganic pollutants and PAHs SPZ3 is used. The results of these calculations are presented in Appendix II, Tables 4.22- 4.32.

In evaluating the results of the 1994 research a different method was used. Research concentrated mainly on sites where serious pollution was expected or had been found in the course of the 1993 research. Therefore, sediment quality was evaluated using Dutch standards that indicate what kind of action should be taken (Tweede Kamer, 1993-1994) These standards indicate whether there is a possible risk to public health and the environment. These values are presented in Appendix II, Table 4.3.

If the `test value' - in Dutch: 'Toetsingswaarde' (T.w.) - is exceeded, then it is deemed necessary to investigate, if this poses a problem for public health, or for the environment. If the `Intervention value' - in Dutch: 'Interventiewaarde' (I.w.) - is exceeded, then this indicates an immediate danger to public health or to the environment. Research should then be carried out as soon as possible to establish whether these dangers are indeed present, and whether the site should be cleaned up.
If there were no test or intervention values, the results were compared to the Dutch standards for desired environmental quality (S.w.).

4.3 Results of research in 1993

As the objectives of the research work in 1993 and 1994 were different, the results of these campaigns are presented separately.

The results of the analysis of the samples.taken during the campaigns in 1993 can be found in Tables 4.4-4.32. The locations where samples were taken are indicated on maps 2-6.

The tables that list the actual concentrations which were found in surface water, with the Russian standards below them, can be found in Appendix II, Tables 4.4-4.21. Conclusions with respect to surface water can be summarized as follows.

As a general conclusion of the research in 1993, with some

caution, it can be said that the water quality of the Volga reflects that of the river Rhine in the late seventies and early eighties. With regard to some contaminants the situation was even worse. For example, the concentrations of mineral oil was extremely high in both the Volga and the Oka rivers in the province of Nizhni Novgorod. This means that the condition of the Volga is worse than the situation of the Rhine today, but better than the disastrous situation that existed in the Rhine in the early seventies, when concentrations of extremely harmful heavy metals like cadmium and mercury were sometimes twenty times higher than levels found today. Yet the situation of the Volga is not very good, and there are several factors that might make the situation worse than it seems from the findings of this research.

Firstly, the Volga transports several times as much water as the river Rhine, thus diluting pollution much more than the Rhine. Secondly the Volga is a rain river, which is also influenced by massive melting of snow in the spring. The result of this might be that pollution attached to suspended matter is transported in waves, during periods of high water discharge, while little is found during periods of smaller flow in summer (which was the period when samples were taken). Another problem is the presence of huge reservoirs. These will store much pollution in sediments, and the huge water bodies will also serve to dilute water soluble pollutants very much Another result of the presence of reservoirs is a raised level of erosion Therefore the concentrations of suspended matter are also raised in the Volga, thus also diluting the pollution found in sediments. The result of our sampling might for these reasons well be an underestimation of the real situation

In order to take representative samples it is necessary to establish how different kinds of polluting substances behave in the Volga. Only then will it be possible to make a reliable assessment of the situation. Therefore, the results of the sampling carried out during these campaigns should be viewed with caution. Nevertheless this random test shows that there is reason for concern, and further research into the situation is needed.

4.3.1. Nizhni Novgorod Province

Research yielded several 'hot spots' of pollution in both the Nizhni Novgorod and the Samara provinces.

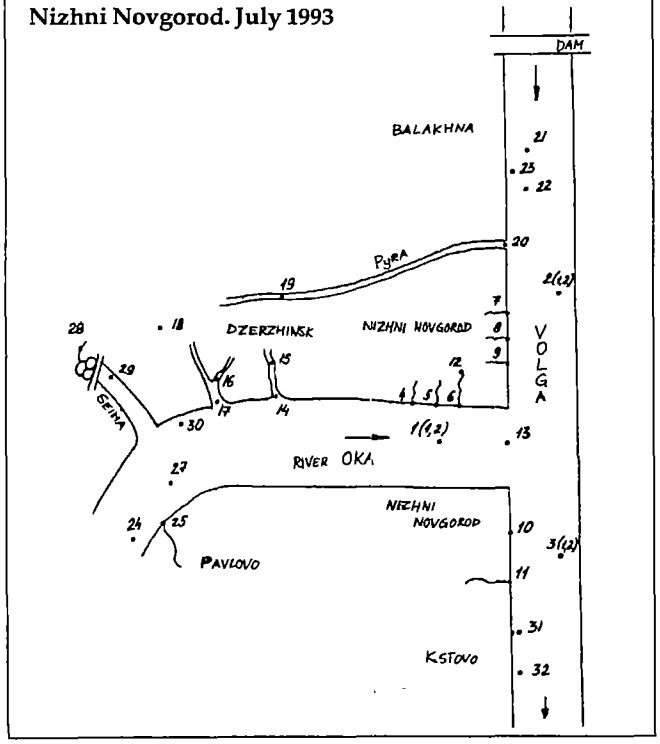
The most polluted spots in Nizhni Novgorod province were:

1. The Volosyanikha canal, especially polluted by mercury and chlororganic compounds like DDT and PCBs. The canal flows past the most important production sites in the city of Dzerzhinsk, where the city's chlorine producing and processing industry is concentrated. In the recent past, most industrial discharges took place in the Volosyanikha canal. At present, only a few discharges remain. Important possible sources of pollution, which still exist, are settling ponds, dumping grounds and drainage water from production sites.

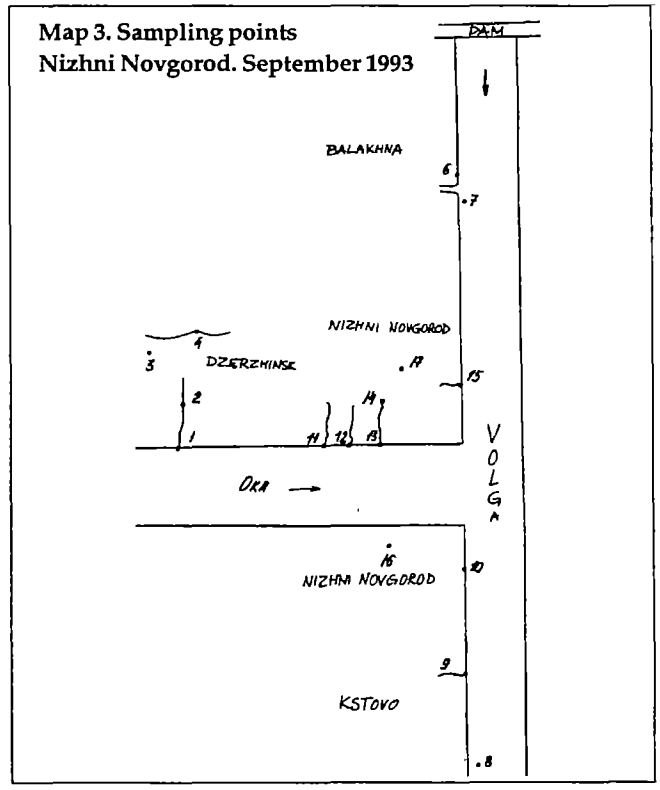
2. The river Rzhavka, located in the lower part of the city of Nizhni Novgorod This river receives the waste water of the Etna plant, which is heavily polluted by heavy metals, PAHs and mineral oil.

3. High levels of mercury and other heavy metals, mineral oil and PAH were found in the Zapadno-strelochny canal, which evacuates drainage water from the GAZ car manufacturing plant and a drinking water purification station.

Map 2. Sampling points Nizhni Novgorod. July 1993



Map 3. Sampling points Nizhni Novgorod. September 1993



4. The river Tarka, in the city of Pavlovo, was polluted by several heavy metals, especially the very toxic pollutant cadmium.

Furthermore, raised levels of PAH and heavy metals were detected in the discharges of the sewage- and waste water treatment facilities at Balakhna (paper- and machine production) and Kstovo (petrochemical industry). In addition, mineral oil and PAH were found in the discharge of drainage water of the Dizel enterprise in the lower part of the city of Nizhni Novgorod.

Discharge of the chemical fertilizers plant, Chapaevsk, 1993.

All these samples were taken in tributaries of the Volga and Oka rivers that contribute quite large quantities of water to the river. As sometimes concentrations of pollutants were quite high, it is probable that also the quantities discharged were important. Analysis of the water from the Volga and the Oka in Nizhni Novgorod showed raised levels of several heavy metals, notably of mercury and copper. Furthermore high concentrations of mineral oil were found. These results also point towards substantial discharges of polluting substances.

4.3.2. Samara Province

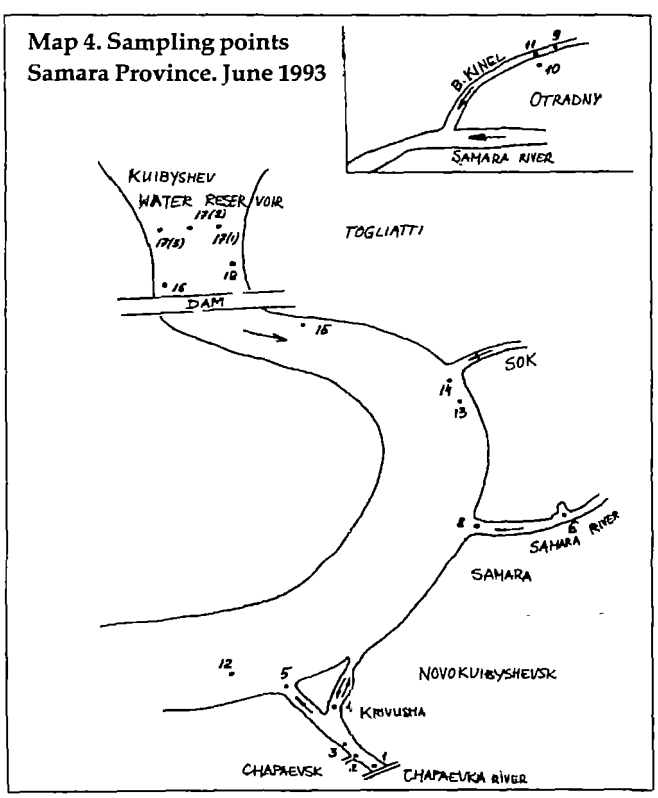
In Samara Province, as in Nizhni Novgorod, the most heavily polluted water was found in tributaries of the Volga.

1. In the city of Chapaevsk almost all analyzed substances surpassed standards many times. Among these were several isomers of Hexachlorocyclohexane, DDT and its metabolites.

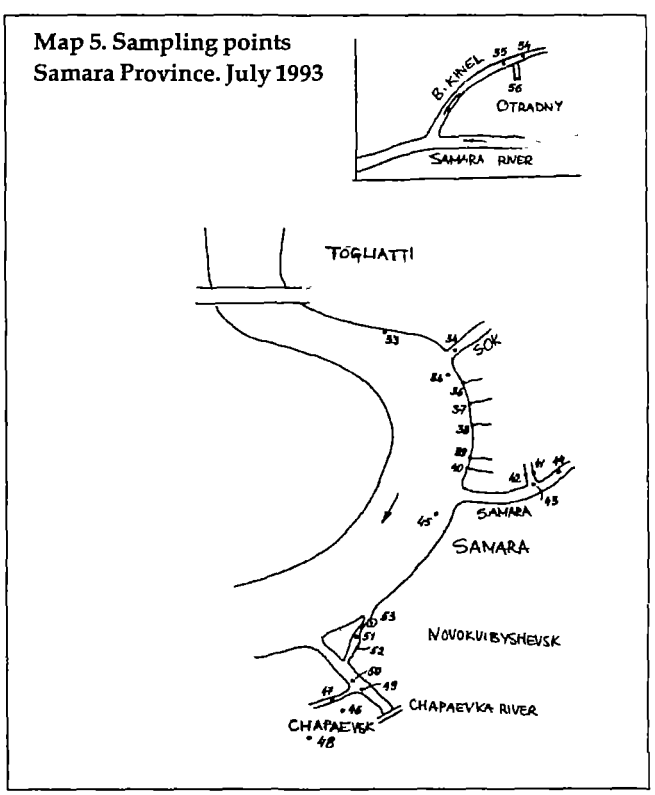
2. At several places raised levels of PAHs were detected. Notably much benzo(a)pyrene, at 'intervention value' level, was found in drainage water from the Maslennikov factory, in drainage water from the Electroshchit plant and in the vicinity of the town of Otradny.

3. High concentrations of heavy metals were found in drainage water from the Maslennikov and Electroshchit

Map 4. Sampling points Samara Province. June 1993



Map 5. Sampling points Samara Province. July 1993



plants and in the river Krivusha in Novokuibyshevsk, where the petrochemical industry of Samara oblast is concentrated.

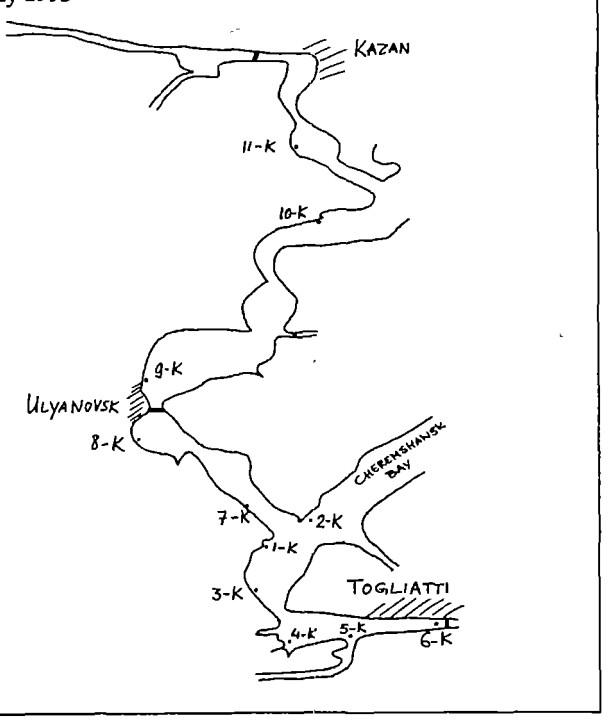
In Samara oblast the pollution also clearly left its mark on the river Volga. Marked was the pollution by chlorphenols and PAH after the water from the river Sok entered the Volga. The concentration of mineral oil was much lower in Samara province than in Nizhni Novgorod.

4.3.3 Kuibyshev water reservoir

In the Kuibyshev water reservoir sediment samples were taken at regular intervals. The purpose of this research was to get a general picture of the pollution of sediments in the river Volga. The most outstanding finding was the high level of DDT pollution that was found in almost every sample. Furthermore, levels of dibutylphtalates and mineral oil were often high. With regard to heavy metals, the concentration of cadmium was elevated almost everywhere, and mercury levels were high at one location. The concentration of other metals was rather low. According to the Russian evaluation system, pollution could be called `dangerous' in six samples, and `moderately dangerous' in five samples, out of a total of eleven. According to Dutch standards, in several samples the pollution was severe enough to justify further research.

The influence of industrial activities is clearly noticeable in the sediment quality in the reservoir. Concentrations of cadmium, mineral oil and phenols are much higher downstream from the city of Ulyanovsk, and the most polluted part of the reservoir is the southern part. Here the highest concentrations of DDT and other chlororganic compounds were found, and near the dam of Togliatti the concentrations of PAH were very high, warranting further research.

Map 6. Sampling points Kuibyshev water reservoir. July 1993



4.3.4 Comparison of government and NGO results

In several cases it was possible to compare the results of the 1993 field work to similar data which was compiled by the Russian government agencies which are responsible for monitoring the state of the environment. Often, samples were taken at the same places both by government agencies and by the coordination team. In general, the results showed the same pattern. But it was found that government data was often very incomplete, as little or no data had been gathered on several substances, and on sediment quality.

4.4 Research results of the second stage, 1994

The results of the 1994 sampling campaigns were not only evaluated by comparing them to standards of desired environmental quality: the research was especially aimed at establishing the necessity to undertake action. Therefore, figures on water and sediment quality were also compared to standards, to indicate whether it was necessary to undertake action.

In general the results of the 1994 research confirm the picture that already was presented in 1993. The level of pollution in the river Volga itself can be compared to that of the river Rhine in the early eighties, while near to industrial centres the influence of industrialization is noticeable, and often heavily polluted spots were found. In fact, pollution was found at almost every site where it was expected. Some problems were researched more thoroughly, and this led to several conclusions:

- At many discharges of waste water PCBs were found either in the discharged water itself or in nearby sediments. Therefore, there was extensive PCB pollution from many sources. This seems to be a problem all over the Volga basin, and further research into the causes is warranted.

- Waste water is often channelled through huge settling ponds before being discharged or treated in purification stations. These ponds have developed into heavily polluted dump sites that pose a threat to the environment The findings in Dzerzhinsk - where a leaking settling pond is an important source of heavy pollution of the Volosyanikha canal - are only an example of a problem that can be encountered in almost every important industrial city along the Volga, and these ponds may be an important source of contamination of the Volga.

- Although, officially, all seriously polluted waste water is discharged through central treatment facilities, several seriously polluted discharges were found of drainage or cooling water being released directly into surface water. These discharges should warrant further research. An example is the high level of copper contamination in water originating from the Dzerzhinsk heat and power plant in Dzerzhinsk (in the province of Nizhni Novgorod). Examples from research in 1993 are: cadmium

pollution in drainage water from the Maslennikov plant in Samara, and cadmium pollution in the river Tarka in the city of Pavlovo (in the province of Nizhni Novgorod).

4.4.1 Nizhni Novgorod

In Nizhni Novgorod several sources of pollution were researched once more at those spots where the results from research in 1993 had pointed towards serious pollution. These locations were:

- the discharges of several power plants in Nizhni Novgorod and Dzerzhinsk.
- the waste water discharge of pulp production installations in the city of Balakhna.
- discharges from the petrochemical complex at Kstovo.
- the Volosyanikha canal in Dzerzhinsk.
- two discharges of drainage water in the lower part of the city of Nizhni Novgorod

The research was specially aimed at detecting the presence of polychlorinated biphenyls in several types of discharges, as these substances had been encountered at many locations during research in 1993.

Several sediment and water samples were also analyzed in the Netherlands, so that - in case the results might be disputed - data from more than one laboratory would be available.

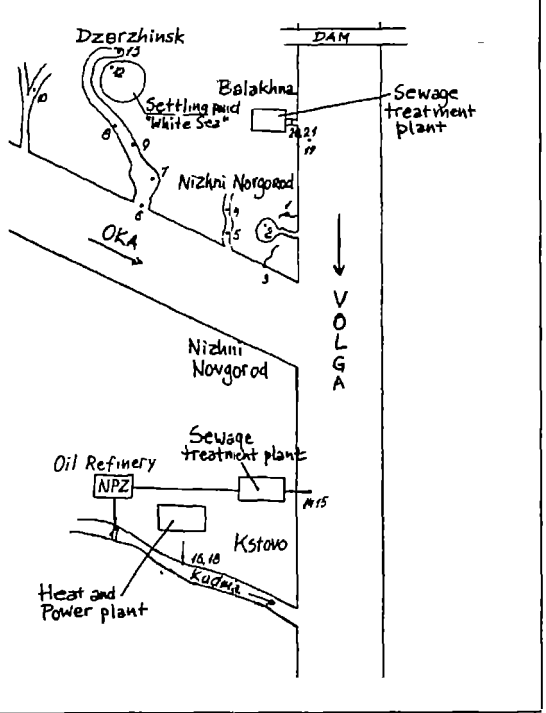
Water sampling in Dzerzhinsk.

An overview of the sample locations in the Nizhni Novgorod province can be found in map 7. The results of Russian and Dutch analysis of 1994 in the Nizhni Novgorod province are presented in Tables 4.33-4.48
Several conclusions can be drawn from the research work:

- PCBs were found in many industrial discharges of different characters where they would not immediately be expected. Analysis, for example, showed PCBs in discharges from power stations and metal processing plants, thus making it clear that the discharge of PCBs is probably a general problem in many industries. Since PCBs are extremely harmful, the many discharges may constitute a serious problem. It is important to establish the reasons for these discharges.

- Further research of the Volosyanikha canal confirmed the results of the research of 1993, pointing towards this canal as one of the most polluted spots in Nizhni Novgorod province and a source of PCB and DDT pollution for the river Oka. Very high concentrations of chlorinated substances were found in the upper reaches of the canal. The research showed that this was historical pollution from industrial discharges, but also new pollution originating from a leaking settling pond, and perhaps from the production site of a chlorine-processing plant. Pollution of the sediments in the Volosyanikha canal was, therefore, serious in that it greatly exceeded Dutch standards for risks to the environment and to health. The results pointed towards the necessity to start investigating the extent of soil pollution and possible pollution sources, since cleanup of the sediments of the Volosyanikha canal alone would do little to ameliorate the situation. Because of these alarming research results, *Let's help the River* started activities which are aimed towards the amelioration of this situation. The account of these activities have been presented in Chapter Two.

Map 7. Sampling points Nizhni Novgorod. June 1994



- High concentrations of copper were found in the discharge of the Dzerzhinsk heat and power plant. A rough calculation of the load carried into the Oka by this discharge puts it at a level of some tens of tons a year. This is in the order of magnitude of the load carried by the river Meuse into the Netherlands. The quantity of zinc discharged is in the same order of magnitude.

- A clear emission of lead was found in the discharge of the Synthez factory in Dzerzhinsk. This is no surprise, since this factory is producing tetra-ethyl-lead. Yet it is a clear sign that the discharge is not limited to clean cooling water, as the Synthez factory maintains. Indeed, the quantity of lead discharged is greatly in excess of the quantity reported to public authorities.

4.4.2 Yaroslavl

Yaroslavl is one of the historical cities of Russia, located about 250 kilometres north of Moscow on the banks of the river Volga. It is now an important centre of the chemical industry (Lakokraska paint factory), the metal industry (engine factory) and the petrochemical industry (oil refinery).

In Yaroslavl, waste-water discharges, surface water from the Volga, and sediments were researched. A complete overview of the results is presented in tables 4.49-4.62. An overview of the sample locations of Yaroslavl is presented in map 8

The research was aimed at several industrial enterprises located on the banks of the river Volga, just upstream from the drinking water intake of Yaroslavl The most important of these was expected to be the Lakokraska paint factory.

In addition to this research, several background samples were taken of surface water and sediments from the Volga. Also, samples were taken from the discharges of the sewage treatment station and the oil refinery.

Several of the results of this research require special attention:

- The content of PAH (Benzo(a)Pyrene) in the water of the river Volga is fairly high everywhere. Both Russian and Dutch water quality values are exceeded at every sample location, and the level of Benzo(a)pyrene is rising as the Volga flows through Yaroslavl. An especially high concentration was found in the area where drinking water for the city of Yaroslavl is taken in. This inlet is located immediately downstream from several of the cities largest plants, the Lakokraska paint factory, and the machine building plant. The raised level of Benzo(a)pyrene was also found in the sediment. At every location Dutch standards for sediment quality were exceeded, sometimes coming very close to values that require further research in order to establish possible danger.

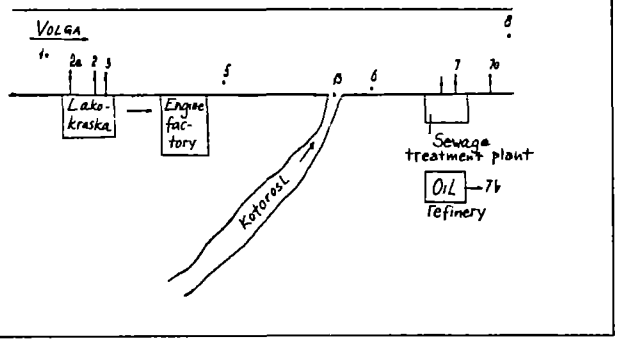
- Though no PCBs were detected in the water of the Volga itself, PCB contamination was found in the sediment of the river, and in sediment near discharges. The levels found in the river represent values that are generally lower than the levels found in the river Rhine, but are in the same order of magnitude. These levels are disturbing, since PCB pollution in the Rhine is exceptionally high, due to excessive use of these substances in German mining. In the Volga, no such sources of PCBs are known. At least three possible sources of PCB pollution were identified in the city of Yaroslavl itself: raised PCB levels were detected in water discharged from the sewage water treatment plant - up to 100 nanograms per litre (ng/l) - and in sediment near the waste water discharges of Lakokraska plant and the oil refinery of Yaroslavl.

- The concentration of nickel, found almost everywhere in the sediment of the Volga, exceeded Dutch standards requiring immediate action, since a serious threat to health and to the environment may be present. Research is needed to establish the nature of this pollution, its danger, and its sources. Since a very high level of contamination is found in the background sample taken upstream from Yaroslavl, the source of this pollution may be located upstream from the city. Yet, as raised levels of nickel contamination were also found near the discharges from the Lakokraska plant, in the river Kotorasl (a tributary of the Volga) and near the discharge of the sewage treatment plant, local sources may also be responsible for extensive pollution.

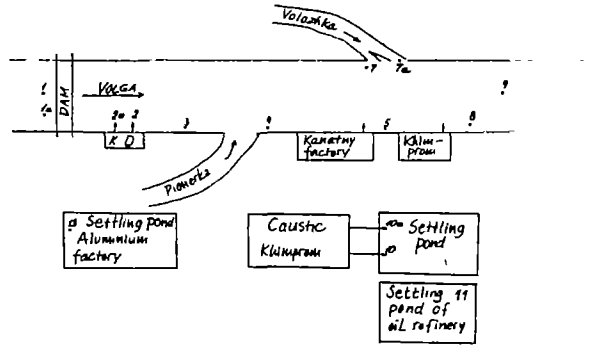
- Mercury pollution exceeding standards requiring further research was found in the sediment near the Lakokraska plant, and near the drinking water intake.

As a general conclusion on the situation in Yaroslavl it can be

Map 8. Sampling points Yaroslavl. August 1994



Map 9. Sampling points Volgograd. August 1994



said that the level of contamination of the Volga is fairly high. The concentration of PAH in water and sediment, and the level of PCB in sediment, is worrying. A very high level of nickel contamination was found and immediate research should be undertaken to verify the level of pollution and establish whether this extensive pollution indeed exists, and which sources are responsible for it.

4.4.3 Volgograd

Volgograd (formerly Stalingrad) is an important industrial city located in the south east of European Russia. It is situated downstream from the last reservoir in the Volga. Through Volgograd, the Volga flows unhampered towards the Caspian Sea, and the city stretches for a length of some sixty kilometres along the western bank of the river. Industry is concentrated in the northern and southern parts of the city. Metallurgical industry (aluminium and steel) is concentrated in the North, while chemical industry (chlorine production and processing and oil refinery) is predominant in the South.

A schematic overview of the sample locations of Volgograd can be found in map 9. The results of research are presented in tables 4.63-4.75.

Research was directed towards several industrial enterprises, which were considered to be possible important polluters of the Volga. As preparatory research did not yield a very clear picture of the actual situation the research resembled that of 1993, and was aimed at identifying important sources of pollution. At regular intervals samples of surface water and sediment were taken in the Volga in its course through Volgograd. Furthermore, samples were taken to get an impression of the discharges of several of the most important industrial companies situated in the city.

In general, the water quality of the river Volga in Volgograd is poor. In many places acceptable levels of copper, zinc and cadmium were surpassed, and there is a slight tendency for concentrations to increase as the river flows through Volgograd. Concentrations decrease again downstream from the city. A dramatic increase of the copper concentration in the river was found downstream from the discharge of the Krasny Oktyabr plant in the north of Volgograd.

No other major industrial discharges were found because, in Volgograd, pollution has a pattern of its own. In this city evaporation exceeds precipitation. As a result, most industrial discharges are diverted into large systems of settling and evaporation ponds, and are not discharged into the river Volga. Pollution is therefore largely concentrated in these settling ponds and likely to threaten the quality of ground water.

Important findings of research in Volgograd were as follows:

- In the settling ponds of Khimprom and Caustic (the chlorine producing and processing plants in the South of the city) concentrations of PCBs and hexachlorbenzene are exceeding Dutch standards to a degree that requires further investigation. These data coincide with the results of analysis of the waste water discharged by both Caustic and Khimprom into the pond: both discharges contained high levels of PCB. Added to this are discharges of mercury, copper and zinc.
- Alarming concentrations of nickel were found in the sediment of the lower part of the Volgograd reservoir and of the Volga. According to Dutch standards for sediment quality these concentrations may pose an immediate threat to health and to the environment, and the problem should be investigated. The concentration diminishes as the Volga flows through Volgograd. So the source of this contamination must be situated upstream from Volgograd. In sediment from the reservoir and the Volga, high concentrations of copper and cadmium were also found, which exceed the standards for sediment quality - though they were not yet in the 'danger zone', requiring urgent measures. The quality of sediments thus did not coincide with the findings of research into surface water quality.

4.5 General conclusions

Environmental research in the Nizhni Novgorod and Samara provinces, and in the cities of Yaroslavl and Volgograd have given better insight into the pollution of the Volga river, its tributaries, and one of its water reservoirs.

The level of pollution in the river Volga itself can be compared to that in the river Rhine in the early eighties. The pollution in several sediment samples from the Kuibyshev water reservoir, according to Dutch standards, was severe enough to justify further research. Near to industrial centres the influence of industrialization is clearly noticeable, and several heavily polluted spots were found in the river's basin.

The possibility to carry out independent research, within the Volga Project, was very important. The involved NGOs would have been in a difficult position, when trying to assess the situation, if they had not had these supplementary research results, since important information was sometimes simply lacking.

Moreover, the results of the independent research were an important instrument for the NGOs in strengthening their position in relation to government agencies and polluters.

It is important to mention that this environmental research would have been difficult to execute without the help of several Russian government agencies, who supplied information, transport, shipping and research materials.

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CHAPTER 5.

CONCLUSIONS, RECOMMENDATIONS AND FUTURE DEVELOPMENTS

Conclusions

Environmental research

Environmental research in the Nizhni Novgorod and Samara provinces, and in the cities of Yaroslavl and Volgograd have given better insight into the pollution of the Volga river, its tributaries, and one of its water reservoirs.

The level of pollution in the river Volga itself can be compared to that in the river Rhine in the early eighties. The pollution in several sediment samples from the Kuibyshev water reservoir, according to Dutch standards, was severe enough to justify further research. Near to industrial centres the influence of industrialization is clearly noticeable, and several heavily polluted spots were found in the river's basin.

The involved NGOs would have been in a difficult position, when trying to assess the situation, if they had not had these supplementary research results, since important information was sometimes simply lacking in the officially available reports.

The results of the independent research were an important instrument for NGOs in strengthening their position in relation to government agencies and polluters.

The hearing

This public hearing on the environmental problems of the Volosyanikha canal has yielded promising results. It proved that the organization of such a hearing offers a good possibility for NGOs to participate in the decision making processes concerning the pollution of the Volga.

The fact that all concerned parties - including public authorities and local industries - participated in the hearing, was a major achievement.

It was important that the coordination team could continuously supply itself with information from the Netherlands.

Furthermore, NGOs' representatives attended the public hearing. The representatives viewed it as a useful method of addressing an environmental problem. They are adapting and introducing this experience in their local situation.

Local environmental NGOs

The approach of combating the industrial pollution of the river Volga, as proposed by the Volga Project, is considered valuable by Russian NGOs. As a result of the project three local organizations, consisting entirely of volunteers, and the project's coordination team, started to deal with their local environmental case.

The participating organizations gained experience in carrying out independent research, in interpreting research results, they learned how to choose case studies, and how to develop an action plan. Actions to reduce the industrial

pollution of the Volga have been set up by them and are proceeding well. It is expected that with these experiences organizations are able to increase their influence on the environmental policy making process in their respective regions.

The involved NGOs are interested in setting up strong regional cooperation between organizations throughout the whole Volga region, that are capable of influencing polluters.

Moreover, several other local organizations have expressed their wish to participate in the Volga Project in the future.

The project also yielded valuable information on the needs of NGOs in the Volga basin, and on the various factors hampering their progress. The organizations from the Volga basin made it clear that they are in need of information and trainings in organization and management skills, and in strategic action planning.

Attitude of public authorities

It is important to mention that this project would have been difficult to execute without the help of several Russian government agencies Their cooperation was especially helpful in organizing the hearing, and during the environmental research campaigns, when they supplied information, transport, shipping and research materials.

On the other hand it was not always easy to obtain information. It took time before trust was built between the parties.

Dutch involvement

At each part of the project, the expertise of the environmental movement from the Netherlands contributed to the realization of new ways to combat the pollution of the Volga river, and it was important to the success of the project that the coordination team of the Volga Project could continuously supply itself with information from the Netherlands.

Milieukontakt Oost-Europa and the Russian project partners have concluded that this intensive Russian-Dutch cooperation should not yet end. Significantly, the *Doen Foundation*, after a visit to local NGOs along the Volga and after attending the hearing in Dzerzhinsk, also came to this conclusion.

International contacts

By publicity on the project's results in Russia and in the Netherlands, and by contacting Russian, Dutch and foreign scientists, the foundation has been laid for further development of international contacts and international attention to the environmental movement and the environmental problems of the Volga region.

Recommendations

- The facilities for NGOs to carry out environmental research should be provided in future
- The idea of organizing a hearing, a round table conference, or other non-confrontational methods in order to successfully participate in the process of environmental decision making, should be adapted by other NGOs along the Volga.
- Dutch-Russian cooperation within the Volga Project should be continued, but in the meanwhile Dutch involvement should become less intensive.
- In order to develop a sustainable network of organizations that combat industrial pollution in the Volga river basin, the number of local organizations participating in the Volga Project should be extended, and further cooperation between them should be stimulated and institutionalized.
- Attention should be paid to the development of organizational and management skills of the NGOs.
- The Volga NGOs should work on the development of their own, Russian, financial basis.
- International cooperation and international attention for the Volga region and Volga NGOs should be further extended.

Future developments

Milieukontakt has submitted a grant application for the follow-up of the Volga Project, to the *TACIS Environmental Support facility*. In 'Volga Project II' the network of local organizations which are working on the industrial pollution of the Volga river will be extended. In this follow-up, more attention will be paid to the internal management of local organizations, in order to strengthen their capacity. In this way it is hoped that they will be able to execute the Volga Project in the future without any direct assistance from Milieukontakt Oost-Europa.
A decision of *TACIS* is expected in the course of 1995.

APPENDIX I

- Letter of Intent to coordinate activities directed at cleaning up the area around the Volosyanikha canal
- Letter from Caprolactam

ПРОТОКОЛ
О НАМЕРЕНИЯХ ПО КООРДИНАЦИИ ДЕЯТЕЛЬНОСТИ, НАПРАВЛЕННОЙ НА ОЗДОРОВЛЕНИЕ ТЕРРИТОРИИ КАНАЛА ВОЛОСЯНИХА /Г.ДЗЕРЖИНСК/.

Администрация г. Дзержинска, департамент по охране природы и управлению природопользованием Администрации Нижегородской области, нижегородский областной комитет охраны окружающей среды и природных ресурсов, дзержинский городской комитет охраны окружающей среды, нижегородский областной центр госсанэпиднадзора, АО "Капролактам", АО "Оргстекло", АО "Синтез", АО "Авиабор", Игумновская ТЭЦ, координационный центр программы "Поможем Реке", учреждение "Мильеконтакт Ост-Европа" (Нидерланды, г. Амстердам), именуемые далее "Договаривающиеся стороны":

- отмечая, что спад промышленного производства не привел к существенному улучшению состояния окружающей природной среды;

- сознавая, что многолетние загрязнения почв и грунтовых вод в районе канала Волосяниха (далее "канала") сделали практически невозможным процесс их самоочищения;

- выражая обеспокоенность возможным значительным ухудшением состояния р. Оки, являющейся источником водоснабжения населения г. Н.Новгорода;

- признавая, что в современных экономических условиях защита и оздоровление территории канала не могут быть обеспечены усилиями лишь одной из договаривающихся сторон,

ДОГОВОРИЛИСЬ о необходимости проведения скоординированных действий, направленных на санирование (оздоровление) территории канала Волосяниха и предотвращение загрязнения р. Оки водами канала.

Стороны намерены осуществлять нижеследующее:

- сократить и постепенно ликвидировать загрязнение канала Волосяниха и прилегающих территорий;

- не допускать действий, приводящих к дополнительному загрязнению почвы и грунтовых вод;

- привлекать необходимые материальные и финансовые ресурсы для проведения работ по санации территории.

Совершено в г. Дзержинске 16 декабря 1994г.

Протокол подписали представители сторон :

От Администрации г.Дзержинска

От Департамента по охране природы и управлению природопользованием Администрации Нижегородской области

От Нижегородского областного комитета охраны окружающей среды и природных ресурсов

От Дзержинского - городского комитета охраны окружающей среды

От Нижегородского областного центра госсанэпиднадзора

От АО "Капролактам"

От АО "Оргстекло"

От АО "Синтез"

От АО "Авиабор"

От Игумновской ТЭЦ

От координационного центра программы "Поможем Реке", от Проекта "Волга"

От Учреждения "Мильеконтакт Ост-Европа", от Проекта "Волга" (Нидерланды, г.Амстердам)

Letter of Intent to coordinate activities directed at cleaning up the area around the Volosyanikha Canal

The Administration of the city of Dzerzhinsk, the Department on Nature Protection of the Administration of the Nizhni Novgorod Province, the Environmental Committee of the Nizhni Novgorod Province, the Environmental Committee of the city of Dzerzhinsk, provincial Sanitary and Epidemiological Agency, the Joint Stock Company "Caprolactam", Joint Stock Company "Orgsteklo", Joint Stock Company "Synthez", Joint Stock Company "Aviabor", Igumnovo Heat & Power Plant, the coordination centre of "Let's Help the River", and the Foundation "Milieukontakt Oost-Europa" (The Netherlands, city of Amsterdam)·

- point out that the decline in industrial production did not result in substantial improvement of the environmental situation;
- understand that contamination of soil and ground water in the area of the Volosyanikha canal (further referred to as `the canal'), which has been going on for many years, has made the process of self-purification practically impossible;
- express their concern about possible significant deterioration of the condition of Oka river, which supplies the citizens of Nizhni Novgorod with drinking water;
- admit that under the current economic conditions protection and the clean-up of the area around the canal can not be achieved by the efforts of only one of the concerned parties,

AGREED upon the necessity to carry out coordinated activities, directed at the clean-up of the area around the Volosyanikha canal area and at prevention of contamination of the Oka river by water from the canal.

The parties intend to implement the following:
- to decrease and gradually terminate the pollution of the canal, and its surroundings;
- to prevent further pollution of the soil and groundwater;
- to look for material and financial resources to clean up the territory around the canal.

Accomplished in the city of Dzerzhinsk, December 16, 1994.

Акционерное Общество
КАПРОЛАКТАМ

606003, г. Дзержинск
Нижегородской обл.
телеграфный: Дзержинск, Алмаз,
651870
Р/счет № 00244505 Коммерческий
банк "Химик", МФО 116284

Joint-Stock Company
CAPROLACTAM

606000, Dzerzhinsk
Nizhny Novgorod region,
Russia,
Telex: 224819 CPRL SU,
Account N 70283001 in VOK bank
for foreign trade of Russia.

от 26.12.94г. №07-277

Об оздоровлении
территории канала
Волосяниха.

Директору Департамента по охране природы и управлению природопользованием
г-ну Каюмову А.А.

Администрация АО внимательно изучила материалы исследования по каналу Волосяниха, полученные в рамках российско-германского проекта "Волга" и ознакомилась с проектом Протокола о намерениях по координации деятельности, направленной на оздоровление территории канала Волосяниха и считает возможным принять на себя следующие обязательства:

– предотвращать, ограничивать и сокращать загрязнение природных объектов, расположенных на территории канала;

– не допускать действий, приводящих к дополнительному загрязнению почвы и грунтовых вод.

Данное письмо администрация АО просит считать неотъемлимой частью вышеуказанного Протокола.

Первый вице-президент В.Я.Колесников

From: Joint Stock Company

CAPROLACTAM

December 26, 1994

To. the Director of the Department on Nature Protection
Mr. A.A.Kayumov

Concerning the clean up of the territory around the Volosyanikha canal

The administration of the Joint Stock Company has thoroughly studied the research materials on the Volosyanikha canal, that were received by the Volga Project, and took notice of the draft Letter of Intent to coordinate activities directed at
cleaning up the area around the Volosyanikha Canal, and considers it possible to accept the following responsibilities:

- to prevent, limit and decrease contamination of the environment around the canal,
- to prevent further pollution of the soil and groundwater.

The administration of the Joint Stock Company requests to consider this letter an indispensable part of the above statement.

First Vice President V.Y. Kolesnikov

APPENDIX II

Environmental research

- Analyzed Substances
- Russian and Dutch surface water standards
- Dutch sediment quality standards
- Research results 1994 (Nizhni Novgorod, Yaroslavl, Volgograd)
- Research results 1993 (water, sediment)

TABLE 4.1

ANALYZED SUBSTANCES

Mercury (Hg)	Nitrates (NO_3)
Cadmium (Cd)	Nitrites (NO_2)
Lead (Pb)	Ammonium nitrogen (NH_4)
Zinc (Zn)	Phosphates (PO_4)
Copper (Cu)	Surface surfactants (SPAV)
Chromium (Cr)	Oil products
Nickel (Ni)	
Arsenic (As)	
Aluminium (Al)	
Iron (Fe)	
Cobalt (Co)	
Manganese (Mn)	

Phenols	Tetrachlorhydrocarbon
Monochlorphenols (MCPh)	Chloroform
Dichlorphenols (DCPh)	Trichlorpropane
Trichlorphenols (TCPh)	Tetrachlorethylene
Pentachlorphenols (PCPh)	Trichlorethylene
	Dichlorethane
	Tetrachlorethane
	Bromoform
	Chlorbenzene

Benzo(a)pyrene (B(a)P)	Hexachlorocylcohexanes (HCH)
Benzoperylene (BPL)	DDT (incl. DDD and DDE)
Pyrene	Hexachlorbenzene (HCB)
Fluoranthene (FLT)	Polychlorinated biphenyls PCBs)
Antracene	Dibutylphtalates (DBF)
Fenanthrene	EOX
Fluorene	
Naftalene	
Toluene	

TABLE 4.2

RUSSIAN AND DUTCH SURFACE WATER STANDARDS (mg/l)

	PDK-s	PDK-f	Dutch standard for desired quality
Mercury (Hg)	0.0005	0.00001	0.00002
Cadmium (Cd)	0.001	0.005	0.0005
Lead (Pb)	0.03	0.1	0.004
Zinc (Zn)	1.0	0.01	0.009
Copper	1.0	0.001	0.003
Chromium (Cr)			0.005
Chromium (Cr) (6+)	0.05	0.02	
Chromium (Cu) (3+)	0.5	0.005	
Nickel (Ni)			0.009
Arsenic (As)	0.5	0.05	
Aluminium (Al)	0.5	-	-
Iron (Fe)	0.3	0.1	-
Cobalt (Co)	0.1	0.01	-
Manganese (Mn)	0.1	0.01	-
Nitrates (NO_3)	45	9.1	-
Nitrites (NO_2)	3.3	0.02	-
Ammonium nitrogen (NH_4)	2.0	0.5	-
Phosphates (PO_4)	3.5	0.25	0.15
Surface surfactants	-	-	-
Oil products	0.3	0.05	-
Phenols	0.001	0.001	-
Monochlorphenols (MCPh)	0.001	0.0004	0.00025
Dichlorphenols (DCPh)	0.002	-	0.00008
Trichlorphenols (TCPh)	0.004	-	0.000025
Pentachlorphenols (PCPh)	0.01	0.005	0.00002
Tetrachlor-hydrocarbon	0.3		-
Chloroform	0.06		-
Trichlorpropane			-
Tetrachlorethylene	0.02		-
Trichlorethylene	0.06		-
Dichlorethane	0.02		-
Tetrachlorethane			-
Bromoform			-
Chlorbenzene	-		
Benzo(a)pyrene (B(a)P)	0.000005	-	0.000003
Benzoperylene (BP)	-	-	0.000001
Pyrene	-	-	-
Fluoranthene (FLT)	-	-	0.000006
Antracene	-	-	0.00002
Fenanthrene -	-		0.00002
Fluorene	-	-	-
Naftalene	0.01	-	0.0001
Toluene	0.5	0.5	-
Hexachlorocyclo-hexanes (HCH)	0.02	0.00001	-
DDT (incl. DDD and DDE)	0.1	0.00001	-
Hexachlorbenzene (HCB)	0.05	-	-
PCBs	-	0.00001	-
Dibutylphtalates (DBF)	0.2	0.001	-
EOX	-	-	-

TABLE 4.3

DUTCH SEDIMENT QUALITY STANDARDS (mg/kg or µg/kg)

	Desired quality (S.w.)	Test-value (T.w.)	Intervention value (I.w.)
(mg/kg)			
Mercury (Hg)	0.3	1.6	10
Cadmium (Cd)	0.8	7.5	12
Lead (Pb)	85	530	530
Zinc (Zn)	140	720	720
Copper	35	90	190
Chromium (Cr)	100	380	380
Nickel (Ni)	35	45	210
Arsenic (As)	29	55	55
(mg/kg)			
Oil products	50	3000	5000
(µg/kg)			
Monochlorphenols (MCPh)	2.5	-	-
Dichlorphenols (DCPh)	3	-	-
Trichlorphenols (TCPh)	1	-	-
Pentachlorphenols (PCPh)	2	5000	5000
(µg/kg)			
Benzo(a)pyrene (B(a)P)	(25)	-	-
Benzoperylene (BP)	(20)-	-	
Pyrene	-	-	-
Fluoranthene (FLT)	(15)	-	-
Antracene	(50)	-	-
Fenanthrene	(45)	-	-
Fluorene	-	-	-
Naftalene	(15)	-	-
Toluene	50	-	130
Sum of 10 PAHs	1000	10000	40000
(µg/kg)			
Hexachlorocyclohexane (HCH)	-	-	2000
DDT (incl. DDD and DDE)	2.5	20	4000
Hexachlorbenzene (HCB)	2.5	20	-
PCBs	20	200	1000
EOX	-	7000	-

The results of the environmental research of 1994 are presented in Tables 4.33 – 4.75.
The results of 1993 (Tables 4.4 – 4.32) are presented at the end of Appendix II.

TABLE 4.33

WATER SAMPLES NIHZNI NOVGOROD PROVINCE. June and october 1994

No Description and place — Date

[Samples analyzed in Russian laboratory]

1. Discharge Sormovo Heat and Power plant. Nizhni Novgorod. 20.06.94
2. Pond of Machine-building factory. Nizhni Novgorod. 20.06.94
3. Discharge GAZ Heat and Power plant. Nizhni Novgorod. 20.06.94
4. Zapadno-Strelochny Canal, upstream. Nizhni Novgorod. 20.06.94
5. Zapadno-Strelochny Canal, downstream. Nizhni Novgorod 20.06.94
6. Mouth of Volosyanikha canal Dzerzhinsk. 21.06.94
7. Lake Telyatyevo. Dzerzhinsk 21.06.04
8. Settling pond of Igumnovo Heat and Power plant. Dzerzhinsk 21.06.94
9. Discharge 1st production site of Syntez factory. Dzerzhinsk 21.06.94
10. Dzerzhinsk Heat and Power plant. Dzerzhinsk. 21.06.94
12. "White Sea", settling pond of Kaprolaktam factory. Dzerzhinsk. 21.06.94
13. Volosyanikha Canal, near Kaprolaktam factory. Dzerzhinsk. 21.06.94
14. Discharge of Oil refinery (NPZ) in the river Volga. Kstovo. [evening sample] 21.06.94
15. Discharge of NPZ in the river Volga. Kstovo. [morning sample] 22.06.94
16. Discharge of Heat and Power plant in the river Kud'ma. Kstovo. [evening sample] 21.06.94
17. Discharge of NPZ in the river Kud'ma. Kstovo. 21.06.94
18. Discharge of Heat and Power plant in the Kud'ma. Kstovo. [morning sample] 22.06.94
19. River Volga, near discharge of biological sewage treatment plant. Balakhna. 23.06.94
20. Discharge well of biological sewage treatment plant. Balakhna. [daily sample] 23.06.94
21. Discharge well of biological sewage treatment plant. Balakhna. [evening sample] 23.06.94

[Samples analyzed in Dutch laboratory]

B21. Discharge well of biological sewage treatment plant Balakhna. 23.06.94

D1a. Volosyanikha Canal, near Kaprolaktam factory Dzerzhinsk. 26.10.94

D1. Volosyanikha Canal, near Kaprolaktam factory. Dzerzhinsk. 26.10.94

D2. Volosyanikha Canal, halfway. 26.10.94

D3. Discharge canal of 1st production site of Synthez factory. 26.10.94

Table 4.34

METALS IN WATER SAMPLES (mg/l). Nizhni Novgorod province. June 1994.

No.	Fe	Cu	Zn	Cr	Ni	Co	Al	Pb	As	Cd	Hg
1.	0.6	0.011	0 006	0.001	-	-	0.10	0.0042	-	-	-
2.	-	0.012	0.059	0.002	0.004	0.0009	-	0.0068	-	0.0009	$<5x10^{-5}$
3.	2.5	0.006	0.008	0.003	-	-	0.72	0.0049	-	-	-
4	-	0.014	0.076	0.002	0.005	0.0018	-	0.0048	-	0.0013	$<5x10^{-5}$
5.	-	0.036	0.107	0.005	0.012	0.0023	-	0.0084	-	0.0005	$<5x10^{-5}$
6.	-	-	-	-	-	-	-	<0.0004	0.0083	-	$<5x10^{-5}$
7.	-	-	-	-	-	-	-	<0.0004	0.0069	-	$<5x10^{-5}$
9.	-	-	-	-	-	-	-	0.1080	0.0019	-	$<5x10^{-5}$
10.	2.9	0.386	0 218	0.016	-	-	0.12	0.0070	0.0044	-	-
12.	-	-	-	-	-	-	-	0.0020	0.0140	-	0.0016
13.	-	-	-	-	-	-	-	0.0160	0.6100	-	0 0010
PDK-f	**0.10**	**0.001**	**0.010**	**0.025**		**0.01**			**0.05**		**0.00001**
PDK-s							**0.5**	**0.03**		**0.001**	
s.w.					**0.009**						

Table 4.35

PCBS AND CHLORORGANIC COMPOUNDS IN WATER SAMPLES (µg/l) Nizhni Novgorod province. June and October 1994.

No.	PCB (kind of PCB prevailing)	p"p-DDT	o"p-DDT	p"p-DDE	HCH	HCB	AOX
1.	n.f.	n.f.	n.f.	n.f.	traces	n.f.	-
2.	0.017 (1230)	n.f.	n.f.	n.f.	n.f.	n.f.	-
3.	n.f.	n.f.	n.f.	n.f.	n.f.	n.f.	-
6.	0.074 (1230)	0.4	0.4	0.018	n.f.	n.f.	-
7.	0.152 (1230)	0.35	0.26	0.018	n.f.	n.f.	-
8.	n.f.	n f.	n.f.	n.f.	n.f.	n.f.	-
9.	traces	n.f.	n.f.	n.f.	n.f.	n.f.	-
10.	0.016 (1230)	n.f.	n.f.	n.f.	n.f.	n.f.	-
12.	0 085 (1230)	n.f.	0.310	n.f.	n.f.	n.f.	-
13	0.043 (halofax)	0.086	0.150	traces	0.022	n.f.	-
14.	traces	n.f.	n.f.	n.f.	n.f.	n.f.	-
15.	n.f.	n.f.	n.f.	n.f.	n.f.	n.f.	-
16.	0.013 (1230)	n.f.	n.f.	n.f.	traces	n.f.	-
18.	0.017	n f.	n.f.	n.f.	n.f.	n.f.	-
19.	n.f.	n.f.	n.f.	n.f.	n.f.	n.f.	-
20.	0 014	n.f.	n.f.	n.f.	n.f.	n.f.	-
21	0.009	n.f.	n.f.	n.f.	n.f.	n.f.	-
B21.	-	-	-	-	-	-	280
D1a.	-	-	-	-	-	-	280000
D1.*	< d	0.25	0.20	0.09	0.15	< d	-
D2.*	< d	< d	< d	< d	< d	< d	-
D3.*	< d	< d	< d	< d	< d	< d	-
PDK-f	**0.01**	**0.01 (sum of DDT + derivates)**			**0.01 (sum)**	-	-
PDK-s						50	-

*) Detection limits of these samples have been elevated, because of the relatively high presence of unknown compounds.

Table 4.36

CHLORPHENOLS IN WATER SAMPLES (mg/l) Nizhni Novgorod province. June 1994.

No.	Monochlor-phenols	Dichlor-phenols	Trichlor-phenols	Pentachlor-phenols
13.	n.f.	n.f.	5×10^{-4}	n.f.
19.	n.f.	2×10^{-4}	n.f.	n.f.
20.	n.f.	5×10^{-4}	n.f.	n.f.
21.	n.f.	10^{-3}	3×10^{-5}	n.f.
PDK-f	2.5×10^{-4}			0.005
PDK-s s.w.		8×10^{-5}	2.5×10^{-5}	

Detection limit: Dichlorphenols 10^{-5} mg/l
Detection limit: Trichlorphenols 10^{-6} mg/l

Table 4.38

BENZO(A)PYRENE IN WATER SAMPLES (ng/l) Nizhni Novgorod province. June 1994.

No.	Benzo(a)pyrene
2.	12.3
4.	88.2
5.	36.4
12.	23.8
13.	9.8
14.	28.0
15.	57.0
16.	34.0
17.	18.0
PDK-s	5.0

Table 4.37

HIGHLY VOLATILE ORGANIC COMPOUNDS IN WATER SAMPLES (µg/l) Nizhni Novgorod province. June 1994.

No.	CCl_4 tetra-chlor-hydro-carbon	$CHCL_3$ chloro-form	C_2CL_4 tetrachlor-ethylene	C_2CL_3 trichlor-ethylene	$C_2H_3Cl_2$ dichlor-ethane	$CHBr_3$ bromo-form	HCB
2.	n.f.	51.2	n.f.	n.f.	n.f.	n f.	n.f.
17.	n.f.	5.5	n.f.	n.f.	n.f.	n.f.	n.f.
PDK-s	300	60	20	60	20		

Detection limit: 0,5 µg/l.

Table 4.39

PAHS IN WATER SAMPLES (ng/l). Nizhni Novgorod province. June 1994

No.	Naftalene	Fluorene	Fenantrene	Antracene	Pyrene	Chrysene	B(a)P	Dibenzo-antracene
8.	1	0.9	26	1	160	0.5	2.5	85
12.	5	5	80	56	750	1.5	1.2	80
PDK-s	10000						5	
s.w.	100		20	20				20
Detection limit sample 8:								
	0.2	0.2	0.06	0.2	6	0.06	0.04	3
Detection limit sample 12:								
	1	0.9	0.3	1	30	0.3	0.2	16

Table 4.40

SEDIMENT SAMPLES NIHZNI NOVGOROD PROVINCE. JUNE AND OCTOBER 1994

No.	Description, Place	Date
	[Samples analyzed in Russian laboratories]	
1.	Discharge Sormovo Heat and Power plant. Nizhni Novgorod.	20.06.94
2.	Pond of Machine-building factory. Nizhni Novgorod.	20.06.94
3.	Discharge GAZ Heat and Power plant. Nizhni Novgorod.	20.06.94
4.	Zapadno-Strelochny Canal, upstream. Nizhni Novgorod.	20.06.94
5.	Zapadno-Strelochny Canal, downstream. Nizhni Novgorod.	20.06.94
7.	Lake Telyatyevo. Dzerzhinsk.	21.06.94
9.	Discharge 1st production site of Syntez factory. Dzerzhinsk.	21.06.94
10.	Dzerzhinsk Heat and Power plant.	21.06.94
11.	River Oka. 2,5 kms downstream from the Volosyanikha Canal. Dzerzhinsk.	21.06.94
12.	"White Sea", settling pond of Kaprolaktam factory. Dzerzhinsk.	21.06.94
13.	Volosyanikha Canal, near Kaprolaktam factory. Dzerzhinsk.	21.06 94
16.	Settling pond of Heat and Power plant. Kstovo.	21.06 94
17.	Discharge of NPZ in the river Kud'ma. Kstovo.	21 06.94
19.	River Volga, near discharge of biological purification facility. Balakhna.	23.06 94
	[Samples analyzed in Dutch laboratory]	
B01.	Discharge Sormovo Heat and Power plant Nizhni Novgorod. (= No.1)	20.06.94
B07.	Lake Telyatyevo. Dzerzhinsk. (= No.7)	21 06.94
B10.	Dzerzhinsk Heat and Power plant. (= No.10) Dzerzhinsk.	21.06.94
B12.	"White Sea", settling pond of Kaprolaktam factory. Dzerzhinsk. (= No.12)	21.06.94
B13.	Volosyanikha Canal, near Kaprolaktam factory. Dzerzhinsk. (= No.13)	21.06 94
B19.	River Volga, near discharge of biological purification facility. Balakhna. (= No.19)	23.06.94
D3B.	Discharge 1st production site of Syntez factory Dzerzhinsk.	26.10.94

Table 4.41

METALS IN SEDIMENT SAMPLES (mg/kg) Nizhni Novgorod province. June 1994.

No.	Cu	Zn	Pb	Fe	Cr	Cd	Ni	Co	Mn	Mg	As	Al	Hg
1.	17.60	68.35	0.992	4814.4	11.41	-	-	-	-	-	-	5716.2	-
2.	301.95	312.53	44.69	-	99.78	2.061	218.4	22.29	226.46	-	-	-	0.09
3.	15.55	79.53	4.620	4175.0	5.785	-	-	-	-	-	-	3870.4	-
4.	73.36	642.0	9.378	-	4.723	0.239	16.30	12.10	-	2650.0	2.14	-	-
5.	6.47	31.23	n.f.	-	1.128	0.213	2.326	11.49	-	825.35	-	-	-
7.	-	-	2.218	-	8.207	-	-	-	-	-	1.17	-	0.26
9.	-	-	18.99	-	3.790	-	-	-	-	-	2.65	-	0.07
11.	-	14.54	n.f.	-	0.148	0.33	-	-	-	-	2.07	-	-
12.	-	-	-	-	-	-	-	-	-	-	2.41	-	0.19
13.	-	-	-	-	10.08	-	-	-	-	-	-	-	-
B07.	37	40	170	-	42	1	22	-	-	-	35	-	2.4
B10.	28	54	<10	-	14	<1	20	-	-	-	4 5	-	<0 1
B12.	22	4	<10	-	8	<1	7	-	-	-	5	-	<0 1
B13.	44	120	40	-	165	2	75	-	-	-	50	-	2.6

Table 4.42

PCBS AND CHLOROGANIC COMPOUNDS IN SEDIMENT SAMPLES (mg/kg) Nizhni Novgorod province. June 1994.

No.	PCBs	(kind of PCB prevailing)	p"p-DDT	o"p-DDT	p"p-DDE	HCH	HCB	EOX
1	0.116	(1254)	0.004	0.017	0.0014	n.f.	n.f.	-
2.	0.210	(1254)	0.011	n.f.	0.0074	n.f.	n.f.	-
3.	0.028	(1254)	0.048	0.0396	0.0045	n.f.	n.f.	-
5	0.035	(1230)	traces	n.f.	traces	n.f.	n.f.	-
7	0.096	(1254)	0.670	0.621	0.0709	n.f.	0.0136	-
9.	0.827		2.335	2.844	0.286	n.f.	0.0373	-
10.	n.f.		n.f.	n.f.	n.f.	n.f.	n.f.	-
11.	n.f.		0.0046	n.f.	traces	n.f.	n.f.	-
12.	0.826	(1254)	0 304	0.238	0.1766	n.f.	0.692	-
13.	0.226	(1254)	5.077	2.592	0.3172	n.f.	n.f.	-
16.	n.f.		n.f.	n.f.	n.f.	n.f.	n.f.	-
17	n.f		0.0418	0.0324	0.0030	n.f.	n f.	-
19.	n.f.		0.0188	traces	traces	n.f.	n.f.	-
B01.	<0.07		< d	< d	< d	< d	< d	-
B07.*	1.0		0.8	0.07	2	0.02	0.1	-
B10.	<0.07		< d	< d	< d	< d	< d	-
B12.*	< d		< d	< d	< d	< d	2.5	150
B13.*	< d		35	5	1	< d	0.3	200
B19.	-		-	-	-	-	-	0.9
D3B.	0.09		< d	< d	< d	< d	< d	-

** Detection limits of these samples have been elevated, because of the relatively high presence of one, or more compounds.*

Table 4.43

CHLORPHENOLS IN SEDIMENT SAMPLES (mg/kg) Nizhni Novgorod province. June 1994.

No.	Monochlor-phenols	Dichlor-phenols	Trichlor-phenols	Pentachlor-phenols
1.	n.f.	n.f.	10^{-4}	n.f.
12.	n.f.	n.f.	n.f.	n.f.
13.	n.f	n.f.	10^{-3}	n.f.
19.	n.f.	10^{-4}	n.f.	n.f.

Detection limit: Dichlorphenols - $7x10^{-5}$
Trichlorphenols - $7x10^{-6}$

Table 4.44

BENZO(A)PYRENE (B(a)P) IN SEDIMENT SAMPLES (µg/kg) Nizhni Novgorod province. June 1994.

No.	B(a)P	No.	B(a)P	No.	B(a)P
2.	9.1	12.	0.9	17	6.3
4.	7.7	13.	4.9	19.	4.2
5.	2.9	16.	4.8		

Table 4.45

PAHS IN SEDIMENT SAMPLES (µg/kg) Nizhni Novgorod province. June 1994.

No.	Naftalene	Fluorene	Fenantrene	Antracene	Pyrene	Chrysene	B(a)P	Dibenzo-antracene
4.	2	2	3	2	250	1	5	170
5.	2	2	1	2	60	1	1	30
12.	1,2	1,1	15	25	300	10	2	60
13.	1	0,9	7	53	50	40	4	78
19.	2	2	1	2	60	1	1	30
Detection limits for samples 12 and 13:								
	1	0.9	0.3	1	30	0.3	0.2	16
Detection limits for samples 4, 5, and 19:								
	0.2	0.2	0.06	0.2	6	0.06	0.04	3

CALCULATED DATA AND EXCEEDINGS OF DUTCH STANDARDS
Nizhni Novgorod province. June and October 1994.

No.	Percentage of Lutum particles (< 0.002 mm)	Percentage of organic matter	No.	Percentage of Lutum particles (< 0.002 mm)	Percentage of organic matter
1. (= B01)	13,4 %	10,0 %	11.	3,3 %	none
2.	15,3 %	19,0 %	12. (= B12)	-	-
3.	12,7 %	9,8 %	13. (= B13)	6,2 %	32,0 %
4.	14,9 %	20,2 %	16.	7,1 %	10,3 %
5.	9,5 %	15,4 %	17.	8,5 %	7,3 %
7. (= B07)	8,3 %	12,0 %	19. (= B19)	4,7 %	8,9 %
9.	5,1 %	7,0 %	D3B.	-	1,6 %
10. (= B10)	8,7 %	8,9 %			

Table 4.46

METALS IN SEDIMENT SAMPLES (mg/kg). Nizhni Novgorod province. June 1994.

(calculated data)

No.	Cu	Zn	Pb	Cr	Cd	Ni	As	Hg
s w	35	140	85	100	0.8	35	29	0 3
T.w.	90	720	530	380	7.5	45	55	1.6
I.w.	190	720	530	380	12	210	55	10
1.	<s.w.	<s.w	<s.w.	<s.w.	-	-	-	-
2.	305.5	351.72	<s.w.	123.7	1.78	302.1	-	<s.w.
3.	<s w.	<s.w.	<s.w.	<s.w.	-	-	-	-
4.	73.24	719.04	<s.w.	<s.w.	<s.w.	<s.w.	<s.w.	-
5	<s.w	<s.w.	n.f.	<s.w.	<s.w.	<s.w.	-	-
7.	-	-	<s.w.	<s.w.	-	-	<s.w.	<s.w.
9.	-	-	<s.w.	<s.w.	-	-	<s.w.	<s.w.
11	-	-	n.f.	<s.w.	<s.w.	-	<s.w.	-
12.	-	-	-	-	-	-	(2.41)	(0.19)
13	-	-	-	<s.w.	-	-	-	-
B07.	49.01	<s.w.	205.5	<s.w.	1.11	42 08	43 90	2.01
B10.	39 44	<s.w.	(<10)	<s.w.	(<1)	37.43	<s.w.	(<0.1)
B12.	(22)	(4)	(<10)	(8)	(<1)	(7)	(5)	(<0.1)
B13.	41.77	144.08	<s.w.	264.42	1.41	162.04	47.89	0.82

Table 4.47

PCBs AND CHLORORGANIC COMPOUNDS SEDIMENT SAMPLES (μg/kg) Nizhni Novgorod province. June 1994.

(calculated data)

No.	PCB	DDT	HCH	HCB	EOX
s w.	20	2.5		2.5	
T.w.	200	20		20	7000
I.w.	1000	4000	2000		
1.	116	22.4	n.f.	n.f.	-
2.	110 5	9.7	n.f.	n.f.	-
3.	28.6	93.9	n.f.	n.f	-
5.	22.7	traces	n.f.	n.f.	-
7.	80	1134.9	n.f.	11 3	-
9.	1181.4	7807.1	n.f.	53.3	-
10.	n.f.	n.f.	n.f.	n.f.	-
11.	n.f.	23	n.f.	n.f.	-
12.	(826)	(718.6)	n.f.	(692)	-
13	70 6	2662.04	n.f.	n.f	-
16.	n.f	n.f.	n.f.	n.f.	-
17.	n.f.	105.75	n.f.	n.f.	-
19.	n.f	21.12	n.f.	n.f.	-
B01.	(< d)	(< d)	(< d)	(< d)	-
B07.	833.3	13225	16.67	83.3	-
B10.	(< d)	(< d)	(< d)	(< d)	-
B12.	(< d)	(< d)	(< d)	(2500)	(150000)
B13.	(< d)	17667	(< d)	100	66667
B19.	-	-	-	-	1011
D3B.	562.5	(< d)	(< d)	(< d)	

Table 4.48

CHLORPHENOLS IN SEDIMENT SAMPLES (micrograms/kg). Nizhni Novgorod province. June 1994.

(calculated data)

No.	MCP	DCP	TCP	PCP
s.w.	2 5	3	1	2
T.w.	-	-	-	5000
I.w.	-	-	-	5000
1.	n.f	n.f.	0.1	n.f.
12.	n.f.	n.f.	n.f.	n.f.
13.	n.f	n.f.	0.31	n.f.
19.	n.f.	0.11	n.f.	n.f.

Table 4.49

WATER SAMPLES CITY OF YAROSLAVL. August 1994

No.	Description, Place	Date
1.	River Volga upstream of Yaroslavl	18.08.94
2.	Discharge of Lakokraska factory, 1st pipe	18.08.94
2a.	Discharge of Lakokraska factory, 2nd pipe	18.08.94
3.	Discharge of Lakokraska factory, 3rd pipe	18.08.94
5.	River Volga near drinking water intake, downstream of Engine factory	18.08.94
7.	Discharge of district sewage treatment plant	19 08.94
7a.	Discharge canal (near discharge of sewage treatment plant)	19.08.94
7b.	Discharge of the oil refinery (NPZ)	19 08.94
8	River Volga, downstream of Yaroslavl	19.08.94

Table 4.50

METALS IN WATER SAMPLES (mg/l) City of Yaroslavl. August 1994.

No.	Cr	Cu	Ni	Co	Zn	Mn	Cd	Pb	Al	Ti	Hg
1.	0.0009	0.0019	0.0018	0.0006	0.009	0.036	0.0007	0.0055	0.37	-	$<5x10^{-5}$
2.	0.2125	0.0049	0.0060	0.0008	0.064	0.941	0.0003	0.0049	0.41	0.004	$<5x10^{-5}$
2a.	0.0085	0.0128	0.0188	0.0007	0.029	7.750	0.0002	0.0065	0.19	0.017	$<5x10^{-5}$
3.	0.0003	0.0036	0 0059	0.0006	0.070	0.586	0.0006	0.0212	0.40	-	0.0001
5.	0.0004	0.0023	0.0011	0.0008	0.027	-	0.0003	0.0063	-	-	$<5x10^{-5}$
7.	0.0226	0.0078	0.0274	0.0010	0.105	-	0.0011	0.0083	-	-	$<5x10^{-5}$
7a.	0.0412	0.0140	0.0282	0.0012	0.148	-	0.0019	0.0168	-	-	$<5x10^{-5}$
7b.	0.0042	0.0243	0.0096	0.0007	0.059	-	0.0049	0.0581	-	-	$<5x10^{-5}$
8.	0.0016	0.0017	0.0033	0.0005	0.024	0.078	0.0004	0.0067	-	-	$<5x10^{-5}$
PDK-f	0.025	0.001		0.01	0.010						0.00001
PDK-s						0.01	0.001	0.03	0.5		
s.w.			0.009								

Table 4.51

PCBS AND CHLORORGANIC COMPOUNDS IN WATER SAMPLES (µg/l) City of Yaroslavl. August 1994.

No.	PCB	p"p-DDT	o"p-DDT	p"p-DDE	HCH	HCB
1.	n.f.	n.f.	n.f.	n.f.	n.f.	n.f.
5.	n.f.	n.f.	n.f.	n.f.	n.f.	n.f.
7.	0.1000	n.f.	n.f.	n.f.	n.f.	n f.
7b	n.f.	n.f.	n.f.	n.f.	n.f.	n f.
8.	n.f.	n.f.	n.f.	n.f.	n.f.	0.006
PDK-f	0.01	0.01 (sum DDT + derivatives)		0.01 (sum)		
PDK-s						50

Table 4.52

CHLORPHENOLS IN WATER SAMPLES (mg/l). City of Yaroslavl. August 1994.

No.	Monochlorphenols-	Dichlorphenols-	Trichlorphenols-	Pentachlorphenols
1.	n.f.	12×10^{-5}	10×10^{-6}	8×10^{-6}
5.	n.f.	n.f.	n.f.	2×10^{-6}
7.	n.f.	8×10^{-5}	14×10^{-6}	4×10^{-6}
7a.	n.f.	12×10^{-5}	8×10^{-6}	8×10^{-6}
7b.	n.f.	6×10^{-5}	6×10^{-6}	2×10^{-5}
8.	n.f.	8×10^{-5}	12×10^{-6}	2×10^{-5}
PDK-f	2.5×10^{-4}			0.005
PDK-s				
s.w.		8×10^{-5}	2.5×10^{-5}	

Table 4.53

HIGHLY VOLATILE ORGANIC COMPOUNDS IN WATER SAMPLE OF DISCHARGE OF THE LAKOKRASKA FACTORY (µg/l) City of Yaroslavl. August 1994.

Compound	Concentration	Standard
CCl_4 (tetrachlorhydrocarbon)	n.f.	PDK-s 300
$CHCL_3$ (chloroform)	12	PDK-s 60
Trichlorpropane	4	
C_2CL_4 (tetrachlorethylene)	n.f.	PDK-s 20
C_2CL_3 (trichlorethylene)	n.f.	PDK-s 60
$C_2H_3Cl_2$ (dichlorethane)	n.f.	PDK-s 20
$C_2H_3Cl_4$ (tetrachlorethane)	4 5	
$CHBr_3$ (bromoform)	n.f.	
Chlorbenzene	n.f.	

Detection limit· 0.5 µg/l

Table 4.54

BENZO(A)PYRENE IN WATER SAMPLES (ng/l) City of Yaroslavl. August 1994

No.	Benzo(a)pyrene
1.	10
2a.	18
5	52
7	15
7a.	33
7b.	23
8.	35
PDK-s	5.0

Table 4.55

SEDIMENT SAMPLES. City of Yaroslavl. August 1994.

No.	Description, Place	Date
1.	Right bank of the Volga river, upstream of the city of Yaroslavl	18.08.94
2.	Right bank of the Volga river, downstream of the discharge of Lakokraska, 1st pipe	18.08.94
2a.	Discharge of Lakokraska, 2nd pipe	18.08.94
3.	Right bank of the Volga river, downstream of the discharge of Lakokraska, 3rd pipe	18.08.94
5.	River Volga, near drinking water intake, downstream of Engine factory	18.08.94
6.	River Volga, downstream of the mouth of the river Kotorosl	19.08.94
7	River Volga, downstream of sewage treatment plant	19 08.94
7b.	Discharge of the oil refinery (NPZ)	19.08.94
8	Volga river, right bank, downstream of the city of Yaroslavl	19.08.94
13	Mouth of the river Kotorosl	19.08.94

Table 4.56

METALS IN SEDIMENT SAMPLES (mg/kg). City of Yaroslavl. August 1994.

No.	Zn	Cu	Cd	Ni	As	Hg	Cr	Pb	Al	Ti
1	14.33	8.60	0.47	71.63	1.53	0.0015	7.16	3.34	4180.5	-
2.	37.86	21.35	0.08	92.29	0.97	0.0016	32.52	3 40	-	1188.2
2a.	37.49	6.33	0.07	43.82	0.68	0.0642	26.77	3 41	-	549.0
3.	38.04	4.45	0.11	39.53	1.48	0.0115	24.36	4.12	3198.6	-
5.	26.97	13.97	0.24	4.82	1.64	0.0354	20.71	5.30	-	-
6.	52.99	17.34	0.05	52.99	1.73	0.0068	16.86	2.41	-	-
7.	95.24	37.90	0.09	179.8	3.21	0.0042	11.18	3.40	-	-
8.	30.10	12.23	0.36	61.15	0.61	0.0204	10.82	5.17	-	-
13.	34.50	19.65	1.47	93.32	1.87	0.0086	9.33	1.47	-	-

Table 4.57

PCBS AND CHLORORGANIC COMPOUNDS IN SEDIMENT SAMPLES (mg/kg) City of Yaroslavl. August 1994

No.	PCB	p"p-DDT	p"p-DDE	o"p-DDT	HCH	HCB
1.	n.f.	n.f.	n.f.	n.f.	n f.	n.f.
2a.	0.0420	traces	traces	traces	n.f.	0.002
5.	0.0028	0.0044	0.0003	0.004	n.f.	0.0002
6.	0.0084	0.0039	0.0008	n.f.	n.f.	0.0037
7.	0.0156	0.0070	0.0038	0.014	n.f.	0.0006
7b.	0.0460	n.f.	n.f.	n.f.	n.f.	n.f.
8.	n.f.	n.f.	n.f.	n.f.	n.f.	n f.
13.	0.0015	n.f.	n.f.	n.f.	n.f.	n.f.

Table 4.58

CHLORPHENOLS IN SEDIMENT SAMPLES (mg/kg) City of Yaroslavl. August 1994

No.	MCPh	DCPh	TCPh	PCPh
1.	n.f.	5×10^{-3}	5×10^{-5}	10^{-5}
2a.	n.f.	2×10^{-3}	10^{-4}	5×10^{-4}
5.	6×10^{-5}	5×10^{-4}	18×10^{-5}	n.f.
6.	2×10^{-2}	1.5×10^{-3}	4×10^{-5}	5×10^{-5}
7.	0.3	n.f.	5×10^{-4}	10^{-4}
7b.	0.2	5×10^{-3}	2×10^{-4}	n f.
8.	10^{-2}	n.f.	7×10^{-5}	n.f.
13.	5×10^{-2}	15×10^{-4}	6×10^{-4}	4×10^{-4}

Table 4.59

BENZO(A)PYRENE (B(a)P) IN SEDIMENT SAMPLES (µg/kg) City of Yaroslavl. August 1994

No.	B(a)P	No.	B(a)P	No.	B(a)P
1.	16	6.	16	8.	8
2a	20	7.	12	13.	6
5.	30	7b	42		

CALCULATED DATA AND EXCEEDINGS OF DUTCH STANDARDS City of Yaroslavl. August 1994.

No.	Percentage of lutum particles (<0.002 mm)	Percentage of organic matter
All samples:	0 %	2 % (in case of organic compounds)
		0 % (in case of metals)

Table 4.60

METALS IN SEDIMENT SAMPLES (mg/kg) City of Yaroslavl. August 1994.

(calculated data)

No.	Zn	Cu	Cd	Ni	As	Hg	Cr	Pb
s.w.	140	35	0 8	35	29	0.3	100	85
T.w.	720	90	7.5	45	55	1.6	380	530
I.w.	720	190	12	210	55	10	380	530
1	40.12	20.64	0.92	250.71	2.95	0.08	14.32	5.6
2	106.0	51.24	0.16	323.02	1.8	0.08	65.04	5.7
2a.	105.0	15.2	0.14	153.37	1.3	3.27	53.54	5.8
3.	106.5	10.6	0.22	138.36	2.86	0.59	48.72	7.0
5.	75.52	33.53	0.43	16.87	3.16	1.81	41 42	9.00
6	148.37	41.62	0.10	185.47	3.34	0,35	33.72	4.1
7.	266 67	90.96	0.18	629.30	6.20	0.21	22.36	5.8
8.	84.28	29.35	0.71	214.03	1.18	1.04	21 64	8.8
13.	96.60	47.16	2.88	326.62	3.61	0,44	18 66	2.5

Table 4.61

PCBs, CHLORORGANIC COMPOUNDS, AND BENZO(A)PYRENE IN SEDIMENT SAMPLES (µg/kg) City of Yaroslavl. August 1994.

(calculated data)

No.	PCB	DDT	HCH	HCB	B(a)P
s.w.	20	2.5		2.5	25
T.w.	200	20		20	
I.w.	1000	4000	2000		
1.	n.f.	n.f.	n.f.	n.f.	80
2a.	210	traces	n.f.	10	100
5.	14	43.5	n.f.	1	150
6.	42	23.5	n.f.	18.5	80
7.	78	124	n.f.	3	60
7b.	230	n.f.	n.f.	n.f.	210
8.	n.f.	n.f.	n.f.	n.f.	40
13.	7.5	n.f.	n.f.	n.f.	30

Table 4.62

CHLORPHENOLS IN SEDIMENT SAMPLES (µg/kg) City of Yaroslavl. August 1994.

(calculated data)

No.	MCP	DCP	TCP	PCP
s.w.	2.5	3	1	2
T.w.	-	-	-	5000
I.w.	-	-	-	5000
1.	n.f.	25	0.25	0.05
2a.	n.f.	10	0.5	2.5
5.	0.3	2.5	0 9	n.f.
6.	100	7.5	0.2	0.25
7.	1500	n.f.	2.5	0.5
7b.	1000	25	1	n.f.
8.	50	n.f.	0.35	n f.
13.	250	7.5	3	2

Table 4.63

WATER SAMPLES
City of Volgograd. August 1994.

No.	Description, Place	Date
1.	Volgograd waterreservoir, area near the dam.	23.08.94
2a.	Volga, upstream of Red October factory.	24.08.94
2b.	Volga, downstream of Red October factory.	24.08.94
5.	Volga, downstream of Kanatny factory.	24.08.94
7.	Volga, upstream of mouth of river Volozhka.	24.08.94
7a.	Volga, mouth of new riverbed of Volozhka (downstream of discharge of sewage treatment plant)	24.08.94
8.	Volga downstream of discharge by Khimprom	24.08.94
9.	Volga, in the vicinity of village "Svetly Yar".	25.08.94
10a.	Waste water from 1st pipe into pond of Khimprom/Kaustik.	25.08.94
10b	Waste water from 2nd pipe into pond of Khimprom/Kaustik.	25.08.94

Table 4.65

PCBS AND CHLORORGANIC COMPOUNDS IN WATER SAMPLES (µg/l)
City of Volgograd. August 1994.

No.	PCB	p"p-DDT	o"p-DDT	p"p-DDE	HCH	HCB
1.	n.f.	n.f.	n.f.	n.f.	n.f.	n.f.
7.	n.f.	n.f.	n.f.	n.f.	n.f.	0.009
7a.	n.f.	n.f.	n.f.	n.f.	n.f.	n.f.
8.	n.f.	n.f.	n.f.	n.f.	n f.	n f.
9.	n.f.	n.f.	n.f.	n.f.	n.f.	n.f.
10a.	3.42	n.f.	n.f.	n.f.	n.f.	n.f.
10b.	4.33	n.f.	n.f.	n.f.	n.f.	n.f.
PDK-f	0.01	0.01 (sum DDT + derivatives)			0.01 (sum)	
PDK-s						50

Table 4.64

METALS IN WATER SAMPLES (mg/l)
City of Volgograd. August 1994.

No.	Cr	Cu	Ni	Co	Zn	Cd	Pb	Hg
1.	0.0009	0.0012	0.0026	0.0005	0.023	0.0006	0.0006	<0.00005
2a	0.0013	0.0025	0.0033	0.0004	0.069	0.0007	0.0019	<0.00005
2b.	0.0008	0.0180	0.0038	0.0003	0.011	0.0004	0.0004	<0.00005
5.	0.0009	0.0025	0.0041	0.0007	0.007	0.0002	0.0001	<0.00005
7.	0.0053	0.0026	0.0047	0.0006	0.026	0.0011	0.0005	<0 00005
7a	0.0010	0.0027	0.0036	0.0004	0.046	0.0005	0.0007	<0.00005
8.	0.0016	0.0034	0.0040	0.0003	0.029	0.0002	0.0001	<0.00005
9.	0.0010	0.0027	0.0049	0.0003	0.020	0.0002	0.0044	<0.00005
10a	0.0077	0.0188	0.0267	0.0004	0.196	0.0032	0.0040	0.00032
10b	0.0073	0.0170	0.0270	0.0003	0.218	0.0021	0.0027	0 00020
PDK-f	0.025	0.001		0.01	0.010			0.00001
PDK-s						0.001	0.03	
s.w.			0.009					

Table 4.66

CHLORPHENOLS IN WATER SAMPLES (mg/l) City of Volgograd. August 1994.

No.	Monochlor-phenols	Dichlor-phenols	Trichlor-phenols	Pentachlor-phenols
1.	n.f.	4×10^{-5}	6×10^{-6}	10^{-5}
7.	n.f.	6×10^{-5}	14×10^{-6}	8×10^{-6}
7a.	10^{-4}	n.f.	2×10^{-5}	10^{-5}
8.	n.f.	4×10^{-5}	24×10^{-6}	n.f.
9.	n.f.	n.f.	n.f.	6×10^{-5}
10a.	n.f.	n.f.	10^{-4}	n.f.
10b.	10^{-4}	6×10^{-5}	6 x 10-6	4 x 10
PDK-f	2.5×10^{-4}			
PDK-s				0.005
s.w.		8×10^{-5}	2.5×10^{-5}	

Table 4.67

BENZO(A)PYRENE IN WATER SAMPLES (ng/l) City of Volgograd. August 1994.

No.	Benzo(a)pyrene
1	6
7.	8
7a.	6
8	4
9.	8
11.	14
12	7
PDK-s	5.0

Table 4.68

SEDIMENT SAMPLES. City of Volgograd. August 1994.

No.	Description, Place	Date
	[Samples, analyzed in Russian laboratories]	
1.	Volgograd waterreservoir, area near the dam.	23.08.94
1a.	Volgograd waterreservoir, area near the dam.	23.08 94
3.	Volga, downstream of dicharges of Red October factory.	24.08.94
4.	River Volga, right bank, downstream of the river Pionerka	24.08.94
5.	River Volga, right bank, downstream of the discharge of the Kanatny factory.	24.08.94
7.	Mouth of the river Volozhka.	24.08.94
8.	Volga downstream of discharge by Khimprom.	24.08 94
10a.	Settling pond of Khimprom/Kaustik, 1st pipe.	25.08.94
10b.	Settling pond of Khimprom/Kaustik, 2nd pipe.	25.08.94
11.	Settling pond of the oil refinery (NPZ).	25.08.94
13.	Settling pond of aluminium factory.	25.08 94
	[Samples, analyzed in Dutch laboratory]	
H100.	Settling pond of Khimprom/Kaustik, 1st pipe.	25.08.94
H121.	Settling pond of aluminium factory.	25.08.94

Table 4.69

METALS IN SEDIMENT SAMPLES (mg/kg). City of Volgograd. August 1994.

No.	Zn	Cu	Cd	Ni	As	Hg	Cr	Pb	Al
1.	84.61	43.98	1.88	291.6	2.15	0.0052	32.03	5.26	-
1a.	54.52	43.67	1.96	265.0	2.16	0.0358	13.25	17.17	-
3.	37.50	33.78	1.74	147.5	5.71	0.0057	12.84	2.38	-
4	13.49	4.94	0.27	n.f.	1.18	0.0231	13.32	9.39	-
5.	17.12	13.21	0.22	88.06	2.45	0.0117	9.30	1.47	-
7.	21.25	10.87	0.08	98.81	1.98	0.0291	15.31	2.47	-
8.	11.33	9.85	0.10	n.f.	1.97	0.0018	19.70	2.96	-
10a.	813.1	769.4	4.85	1907.8	1.84	0.0339	19.42	7.28	-
10b.	61.35	7.73	0.09	4.83	1.35	0.0015	9.18	2.42	-
13.	21.07	33.82	0.07	24.51	2.75	0.0205	8.33	5.39	7531.3
H100.	7500	960	15	335	6	17.5	750	220	-

Table 4.70

PCBS AND CHLORORGANIC COMPOUNDS IN SEDIMENT SAMPLES (mg/kg) City of Volgograd. August 1994

No.	PCB	p"p-DDT	p"p-DDE	o"p-DDT	HCH	HCB	EOX
1.	n.f.	n f.	n.f.	n.f.	n.f.	n.f.	-
1a.	n.f.	n.f.	n.f.	n.f.	n.f.	n.f.	-
7.	n f	n.f.	n.f.	n.f.	n.f.	n.f.	-
8.	n.f	n.f.	n.f.	n.f.	n.f.	n.f.	-
10a.	2 052	n.f.	n.f.	n.f.	n.f.	0.5345	-
10b.	0.3620	n f	n.f.	n.f.	n.f.	0.0098	-
H100	<0.350	<0.050	<0.050	0.070	<0.250	2.5	47

Table 4.71

BENZO(A)PYRENE IN SEDIMENT SAMPLES (μg/kg) City of Volgograd. August 1994.

No.	B(a)P
	3
...	6
7.	7
11.	115
13.	180
H121.	5500

Table 4.72

CHLORPHENOLS IN SEDIMENT SAMPLES (mg/kg) City of Volgograd. August 1994.

No.	MCPh	DCPh	TCPh	PCPh
1.	0.2	5×10^{-4}	10×10^{-4}	3×10^{-4}
1a.	n.f.	n.f.	15×10^{-5}	2×10^{-5}
7.	2×10^{-2}	n.f.	25×10^{-5}	n f.
8	n.f.	n.f.	2×10^{-3}	10^{-4}
10a.	0.02	5×10^{-4}	14×10^{-4}	2×10^{-4}
10b.	0.01	5×10^{-4}	2×10^{-3}	5×10^{-5}

CALCULATED DATA AND EXCEEDINGS OF DUTCH STANDARDS City of Volgograd. August 1994.

No.	Percentage of lutum particles (< 0.002 mm)	Percentage of organic matter
1	4.3 %	6.0 %
1a.	4.0 %	5.8 %
3.	7.2 %	13.5 %
4	1.6 %	none
5.	4.9 %	4 0 %
7.	6.9 %	17.0 %
8.	2.0 %	none
10a. (= H100)	-	-
10b	1.7 %	none
11.	-	-
13 (= H121)	5.9 %	14.0 %

Table 4.73

METALS IN SEDIMENT SAMPLES (mg/kg) City of Volgograd. August 1994.

(calculated data)

No.	Zn	Cu	Cd	Ni	As	Hg	Cr	Pb
s.w	140	35	0.8	35	29	0.3	100	85
T.w.	720	90	7.5	45	55	1.6	380	530
I.w.	720	190	12	210	55	10	380	530
1.	164 75	75.29	2.65	713.71	<s.w	<s.w.	<s.w.	<s.w.
1a.	<s.w.	74.75	2.80	662.5	<s.w.	<s.w.	<s.w.	<s.w.
3.	<s.w.	44.35	1.86	300.15	<s.w.	<s.w.	<s.w	<s.w.
4.	<s.w.	<s.w.	<s.w.	n.f.	<s.w.	<s.w.	<s.w.	<s.w.
5.	<s.w.	<s.w.	<s.w.	206.85	<s.w.	<s.w.	<s.w.	<s.w.
7.	<s.w.	<s.w.	0.8	204.64	<s.w.	<s.w.	<s.w.	<s.w.
8.	<s.w.	<s.w.	<s.w.	n.f.	<s.w.	<s.w.	<s.w.	<s.w.
10a	(813.1)	(769.4)	(4.85)	(1907.8)	(1.84)	(0.03)	(19.42)	(7.28)
10b.	155.9	<s.w.	<s.w	<s.w.	<s.w.	<s.w.	<s.w.	<s.w.
13.	<s.w.	45.19	<s.w.	53.95	<s.w.	<s.w.	<s w.	<s.w.
H100.	(7500)	(960)	(15)	(335)	(6)	(17.5)	(750)	(220)

Table 4.74

PCBs, CHLORORGANIC COMPOUNDS, AND BENZO(A)PYRENE IN SEDIMENT SAMPLES (μg/kg). City of Volgograd. August 1994.

(calculated data)

No.	PCB	DDT	HCH	HCB	B(a)P	EOX
s.w.	20	2.5		2.5	25	
T.w.	200	20		20		7000
I.w.	1000	4000	2000			
1.	n.f.	n.f.	n.f.	n.f.	5.0	-
1a	n.f.	n.f.	n.f.	n.f.	10.3	-
7.	n f.	n.f.	n.f.	n.f.	4.1	-
8.	n.f.	n.f.	n.f.	n.f.	-	-
10a.	(2052)	n.f.	n.f.	(534.5)	-	-
10b.	1810	n.f.	n.f.	49	-	-
11.	-	-	-	-	(115)	-
13.	-	-	-	-	128.6	-
H100.	(<350)	(70)	(<50)	(2500)	-	(47000)
H121.	-	-	-	-	3929	-

Table 4.75

CHLORPHENOLS IN SEDIMENT SAMPLES (μg/kg)) City of Volgograd. August 1994.

(calculated data)

No.	MCP	DCP	TCP	PCP
s.w.	2.5	3	1	2
T.w.	-	-	-	5000
I.w.	-	-	-	5000
1.	333 3	0.8	1.7	0.5
1a.	n.f.	n.f.	0.26	0.03
7.	11.8	n.f.	0.15	n.f.
8	n.f.	n f.	10	0.5
10a.	(20)	(0.5)	(1.4)	(0.2)
10b.	50	2.5	10	(0.25)

TABLE 4.4

WATER SAMPLES SAMARA PROVINCE. June 1-7, 1993.

No.	Site location	Date
1.	Wall of landing stage, Chapaevsk.	01.06.93
2.	River Chapaevka. Mouth of Otvodnoi canal.	01.06.93
3.	River Chapaevka. 1.5 km downstream of Otvodnoi canal.	01 06.93
4.	Mouth of river Krivusha (downstream of discharges from the city of Novokuibyshevsk)	01.06.93
5	Mouth of Chapaevka river. Settlement of Kresty.	01.06 93
6.	River Samara, Mouth of Krasnoye lake.	02.06.93
6{1}	-"-	10.35 am
6{2}	-"-	9.00 pm
6{3}	-"-	03.06.93 5.00 am
7.	River Samara, settlement of Alexeevka.	02 06.93
8	Mouth of Samara river. Landing stage of Vasilisk.	03.06.93
9.	River Bolshoi Kinel, 10 km upstream of drinking water intake of Otradny city.	03.06.93
10.	Drinking water, in the city of Otradny	03.06 93
11.	River B.Kinel, drinking water intake.	03.06.93
12.	River Volga, 500 m downstream of discharge of the biological sewage treatment plant of the city of Samara.	04.06.93
13.	River Volga, at Studenyi ravine.	04.06.93
14.	River Volga, 1 km downstream of confluence with river Sok.	04 06.93
15.	River Volga, settlement of Fyodorovka, discharges of the city of Togliatti.	04.06.93
15{1}	-"-	3.00 pm
15{2}	-"-	8.30 pm
15{3}	-"-	05.06.93 5.30 am
15{4}	-"-	3 00 pm
16.	River Volga, the lower reaches of the Kuibyshev water reservoir, at the Zhigulevsk construction materials plant	05.06.93
17.	River Volga, settlement of Yagodnoye, upstream of the dam	06.06.93
17{1}	200 m from the right bank of the Kuibyshev water reservoir;	06.06.93
17{2}	Middle of Kuibyshev water reservoir	06 06 93
17{3}	Kuibyshev water reservoir, flow axis (1 km from the left bank)	06.06.93
18.	River Volga, drinking water intake for the city of Togliatti, settlement of Klimovka	06.06.93

TABLE 4.5

HEAVY METALS IN WATER SAMPLES (mg/l). Samara province. June, 1993.

No	Cu	Pb	Co	Cd	Cr	Mn	Zn	Hg
1	0.0075	0.00096	0 00094	0.00068	0 0055	0.177	0.0144	d
2	0.0079	0 00104	0 00079	0 00046	0.0054	0.156	0.0153	0.00006
3	0.0299	0.00087	0 00072	0.00080	0.0050	0.158	0.0193	d
4	0.0047	0.00075	0.00010	0.00041	0 0014	0.04	0 0071	d
5	0 0023	0 00068	0 00014	0 00820	0 0010	0 051	0.0081	d
6{1}	0 0058	0 00085	0 00023	0 00020	0 0043	0.103	0.0075	d
6{2}	0.0063	0.00090	0.00034	0 00033	0 0102	0.105	0.0066	0 00005
6{3}	0.0062	0 00087	0.00024	0.00022	0 0125	0.111	0.0056	0.00005
7	0.0035	0 00071	0 00032	0.00023	0.0024	0.139	0.0106	0.00005
8	0.0039	0.00082	0.00050	0.00012	0.0022	0 105	0.0052	0.00005
9	0 0038	0 00047	0.00068	0.00002	0.0047	0 140	0 0068	0.00005
10	0 0031	0 00022	0.00027	0.00001	0 0038	0.012	0.0160	0.00005
11	0.0030	0.00047	0 00024	0.00004	0.0025	0.08	0.0172	0.00005
PDK-f	0.001		0.01		0.025	0.01	0.01	0.00001
PDK-s		0.03		0.001				

No	Cu	Pb	Co	Cd	Cr	Mn	Zn	Hg
12	0.0034	0.00035	0.00028	0.00007	0 0008	0 019	0 0128	0.00005
13	0.0028	0.00046	0.00012	0.00006	0.0010	0 03	0 0151	0.00005
14	0.0015	0.00029	0.00028	0.00004	0.0007	0 02	0.0052	0.00005
15{1}	0.0018	0.00138	0.00012	0.00005	0 0010	0.019	0.0123	0.00005
15{2}	0.0037	0 00152	0.00011	0.00038	0 0009	0.02	0 0062	0.00005
15{3}	0 0029	0 00154	0.00017	0.00005	0 0008	0.018	0.0115	0.00005
15{4}	0.0029	0.00141	0.00008	0.00014	0.0009	0.02	0.0086	0 00005
16	0.0023	0.00039	0.00016	0 00010	0.0006	0.013	0.0028	0.00005
17	0.0021	0.00042	0 00004	0.00009	0.0007	0 00	0 0035	0.00005
17{1}	0.0031	0.00039	0.00012	0 00005	0 0006	0 018	0.0044	0.00005
17{2}	0.0026	0.00045	0.00020	0.00010	0 0005	0.03	0.0034	0.00005
18	0.0021	0 00038	0 00007	0 00002	0.0007	0 015	0.0067	0 00005
PDK-f.	0.001		0.01		0.025	0.01	0.01	0.00001
PDK-s		0.03		0.001				

TABLE 4.6

CHLORORGANIC COMPOUNDS IN WATER SAMPLES (μg/l). Samara province. June, 1993.

No	αHCH	βHCH	γHCH	ΣHCH	HCB	DDE	DDT	DBF
1	0.999	0 118	0.920	2.037	0.114	0.157	n f	300
2	0.438	0 076	0.667	1.181	0.030	0.050	n.f.	300
3	0.710	0 124	1.943	2.777	0.036	0.153	n.f.	1000
4	n.f	n.f.	n.f.	n.f.	n f.	n.f.	n.f.	30
5	0.034	0.006	0.130	0.17	n.f.	0.011	n.f.	300
8	0.002	n f	0 050	0.052	n.f.	traces	n.f.	50
9	n.f	n f.	n.f.	n.f	n.f.	n.f.	n f.	20
12	n.f.	n.f	n f.	n.f	n.f.	n f.	n.f.	50
14	n f.	n f.	n.f	n.f.	n.f.	n.f.	n.f.	30
16	traces	n.f.	n.f	traces	n.f.	n.f.	n.f.	70
18	n.f.	n f	n f.	n.f	n.f.	n.f.	n.f.	30
PDK-f	-	-	-	0.01	-	-	0.01	1
PDK-s	-	-	4	-	50	-	0.01	-

TABLE 4.7

PAHs IN WATER SAMPLES (ng/l). Samara province. June, 1993.

No	B(a)P	BPL
1	14.1	19.0
2	2 8	40.5
3	2 5	2 0
4	24.0	29.0
5	0.8	12.0
6{1}	1 9	10 0
6{2}	2.7	17 0
6{3}	0.8	10.0
7	1 3	15.0
8	3.2	6.0
9	1.0	5.0
10	1.8	10 0
11	11.9	15 0
12	0 8	9 0
13	1.0	7.0
14	4.3	18.0
15{1}	1.0	8 0
15{2}	1.3	10 0
15{3}	1.0	7 0
15{4}	0.5	6 0
PDK-s	5	
S.w.		1

TABLE 4.8

MAH and PAHs IN WATER SAMPLES (ng/l). Samara province. June, 1993.

No	Toluene	Naftalene	Fluorene	Fenan-threne	Anthracene	Fluoran-thene	Pyrene	B(a)P	BPL
1	640	10 4	d	22.0	35.2	d	d	3 0	6.0
2	d	d	d	d	d	d	d	2.0	10 0
3	2600	d	d	d	d	d	d	2.0	1 8
4	d	d	d	d	d	d	d	20.0	15.0
6{2}	d	d	d	d	d	d	d	2 0	10 0
7	d	d	d	d	d	d	d	1.0	8.0
14	d	d	d	d	d	d	d	3.0	8 0
PDK-f	500000	-	-	-	-	-	-	5	-
S.w.	-	100	-	20	20	6	-	3	1

TABLE 4.9

BASIC CHEMICAL ANALYSIS OF WATER SAMPLES (mg/l). Samara Province. June, 1993.

No	NH_4	NO_2	NO_3	PO_4	SPAV	Oil products
1	1.45	0.041	0.49	0.166	0.01	-
2	0.92	0.041	0.57	0.200	0 06	-
3	1.43	0.039	0.59	0.152	0.07	-
4	0.51	0.023	0.73	0.006	0.02	-
5	0.29	0.022	0.78	0.047	0.01	-
6{1}	1.25	0.104	0.16	0.020	0.01	0.06
6{2}	1.11	0.117	0.17	0.008	0.03	0.06
6{3}	1.65	0.122	0.16	0.017	0.02	0.10
7	0.96	0.075	0.25	0.012	0.02	0.05
8	1.64	0.049	0.29	0.017	0.01	0.07
9	0.26	0.027	1.02	n.f.	0.02	0.06
12	0.19	0.005	0.59	0.003	0.02	0 05
13	0.32	0.041	0.63	0.002	0.04	0.03
14	0.40	0.035	0.85	n.f.	0.02	0.04
15{1}	0.91	0.002	1.07	n.f.	0.03	0.22
15{2}	0.86	0.248	7.94	0.002	0.03	0 09
15{3}	0.46	0.059	4 77	0.005	0.02	2.29
15{4}	0.34	0.005	0.77	0.002	0 02	0.12
PDK-f	0.5	0.02	9.1	0.25	0.1	0.05

TABLE 4.10

CHLORPHENOLS IN WATER SAMPLES (mg/l). Samara province. June, 1993.

No	MCPh	DCPh	TCPh	PCPh	Phenols
1	$19\cdot10^{-3}$	$5\cdot10^{-5}$	$9\cdot10^{-5}$	$2\cdot10^{-6}$	
2	$2.4\cdot10^{-2}$	$9.2\cdot10^{-4}$	$2.1\cdot10^{-2}$	n.f.	
3	$9\cdot10^{-3}$	$2.9\cdot10^{-4}$	$2.5\cdot10^{-3}$	n f.	
4	$4\cdot10^{-3}$	$1\cdot10^{-4}$	$1.5\cdot10^{-4}$	$6\cdot10^{-6}$	$1.6\cdot10^{-2}$
5	n.f.	n.f.	$5\cdot10^{-6}$	n.f.	$1\cdot10^{-4}$
8	$1.9\cdot10^{-5}$	$4\cdot10^{-7}$	$6\cdot10^{-7}$	$9\cdot10^{-8}$	
9	$1.6\cdot10^{-5}$	$2\cdot10^{-7}$	$2\cdot10^{-7}$	$4\cdot10^{-7}$	
10	$5\cdot10^{-3}$	$11\cdot10^{-5}$	$107\cdot10^{-6}$	n.f.	
11	$4\cdot10^{-4}$	$1.4\cdot10^{-4}$	$0.8\cdot10^{-5}$	n.f.	
12	n.f.	$5\cdot10^{-5}$	$4.8\cdot10^{-5}$	$4\cdot10^{-6}$	
13	$8\cdot10^{-3}$	$6\cdot10^{-5}$	$212\cdot10^{-6}$	n.f.	
14	$1.5\cdot10^{-2}$	$6\cdot10^{-5}$	$6.6\cdot10^{-5}$	n.f.	
15{3}	n.f.	$8\cdot10^{-5}$	$9\cdot10^{-5}$	$4\cdot10^{-6}$	
PDK-s	$1\cdot10^{-3}$	$2\cdot10^{-3}$	$4\cdot10^{-3}$		
PDK-f				$5\cdot10^{-3}$	$1\cdot10^{-3}$
S.w.	$2.5\cdot10^{-4}$	$8\cdot10^{-5}$	$2.5\cdot10^{-5}$	$2\cdot10^{-5}$	

Table 4.11

WATER SAMPLES. Nizhni Novgorod and Samara provinces. August, 1993.

No.	Site location	Date
1{1}	River Oka, boundery of Nizhni Novgorod	5.07.93 3.00 pm
1{2}	River Oka, boundery of Nizhni Novgorod	5.07.93 8.00 pm
2{1}	River Volga, northern boundery of Nizhni Novgorod	15.07.93 6.00 pm
2{2}	River Volga, northern boundery of Nizhni Novgorod	15.07.93 11.00 pm
3{1}	River Volga, southern boundery of Nizhni Novgorod	16.07.93 0.00 am
3{2}	River Volga, southern boundery of Nizhni Novgorod	16.07.93 7.00 am
4.	Mouth of the Zapadno-Strelochni canal, Nizhni Novgorod	15.07.93
5.	Mouth of the discharge of the Dizel plant Nizhni Novgorod	15.07.93
6.	Mouth of Rzhavka river, Nizhni Novgorod	15.07.93
7.	Mouth of river Chernaya, Nizhni Novgorod	15 07.93
8.	Mouth of river Levinka, Nizhni Novgorod	15.07 93
9.	Burnakovskaya flood plain, Nizhni Novgorod	15.07.93
10.	Discharge of sewage treatment plantof the city of Nizhni Novgorod	16.07.93
11.	Mouth of river Rakhma, Nizhni Novgorod	3.07.93
12.	River Rzhavka, near discharge of Etnafactory, Nizhni Novgorod	15.07.93
13.	Mouth of Oka river, Nizhni Novgorod	15.07.93
14	Mouth of Volosyanikha canal, city of Dzerzhinsk	19.07.93
15.	Canal Volosyanikha, halfway	19 07.93
16.	Mouth of the canal of the Korund factory at the point of confluence with the canal of the Dzerzhinsk Heat and Power Plant	19.07.93
17.	Mouth of the canal of the Dzerzhinsk Heat and Power Plant	19.07.93
18.	Drinking water of the city of Dzerzhinsk	9.07.93
19.	River Pyra, downstream of confluence with discharge of Sverdlov plant	19.07.93
20.	Mouth of river Pyra	21.07.93
21.	River Volga, 1 km upstream of discharge of the Biological sewage treatment plant of the Balakhna IndustrialComplex	21.07.93
22.	River Volga, downstream of discharge of Biological sewage treatment plant of the Balakhna Industrial Complex	21.07.93
23.	River Volga, in the area of the discharge of Biological sewage treatment plant	21.07.93
24.	Oka river, upstream of the city of Pavlovo	22.07 93
25.	Mouth of the river Tarka, city of Pavlovo	2.07.93
26.	Not taken.	
27.	River Oka, downstream of Pavlovo	22.07.93
28.	River Yuganets, downstream of the discharge of the poultry farm of Ilyinogorsk	22.07.93
29.	Seima canal	22.07.93
30.	River Oka in the area of the Zhelnino drinking waterintake of Dzerzhinsk	23.07.93
31.	River Volga in the area of the discharge of the Oil refinery of Kstovo	23.07.93
32.	River Volga, near settlement Bezvodny	23.07.93
33.	River Volga, near settlement Pribrezhny	26.07.93
34.	Mouth of river Sok	26.07.93
35.	River Volga, 1 km downstream of river Sok	26.07.93
36.	Discharge of Electroschit factory city of Samara	26.07.93
37.	Mouth of the collector of the industrial part of the city of Samara	26.07.93
38	Mouth of the KATEK collector, Samara	26.07.93
39.	Discharge of Maslennikov plant, Samara	27.07.93
40.	Discharge of Maslennikov plant, Samara	27.07.93
41.	Discharge (first pipe) at Krasnoye lake, city of Samara	28 07.93
42	Discharge (second pipe) at Krasnoye lake, city of Samara	28.07.93
43.	Mouth of Krasnoye lake	28.07.93
44.	Lermontov Bay of Samara river, (discharges of Polet and aviation plant)	28.07.93
45.	River Volga in the area of Korovye Island (discharge of sewage treatment plant of Samara city)	28.07.93
46.	Treated discharge of sewage treatment plant of Chapaevsk city	29.07 93
47.	Discharge of the Polymer and Metallist plant, city of Chapaevsk	29.07.93
48.	Artesian drinking water intake, Chapaevsk	9.07.93
49.	River Chapaevka, mouth of Otvodnoi canal	9.07.93
50.	River Chapaevka, 1km downstream of the Otvodnoi canal	29.07.93
51.	River Krivusha in the area of the discharge of the sewage treatment plant of the city of Novokuibyshevsk	29.07.93
52.	Discharge of Synthetic alcohol factory, city of Novokuibyshevsk.	29.07.93
53.	Settling pond of Heat & Power Plant 1 Novokuibyshevsk city	29.07.93
54.	River Bolshoi Kinel, drinking water intake city of Otradny	30.07.93
55.	River B.Kinel, downstream of sewage treatment plant, city of Otradny	30 07.93
56.	Discharge of sewage treatment plant of Otradnyi city	30.07.93

TABLE 4.12

HEAVY METALS IN WATER SAMPLES (mg/l). Nizhni Novgorod and Samara provinces. July, 1993.

No	Mn	Fe	Cu	Zn	Cr	Pb	Cd	Al	Hg
1[1]	0 12	0.48	0.005	0.010	0.003	0.0009	0.00013	0.29	0.00012
1[2]	0.12	0 49	0.005	0.011	0.004	0.0013	0.00013	0.32	< d
2[1]	0.06	0.18	0 004	0 021	0.001	0.0021	0 00035	0.12	0 00005
2[2]	0.09	0.21	0.005	0.031	0.001	0.0006	0.00060	0 13	0.00007
3[1]	0.12	0.53	0.007	0.025	0.004	0.0011	0.00024	0.36	0.00007
3[2]	0.12	0 51	0 006	0.028	0.004	0.0017	0.00019	0.37	0.00005
4	1.10	5.92	0.025	0.126	0.013	0.0280	0 00032	41.20	0.00007
5	0.30	1.56	0.022	0.038	0.005	0.0267	0.00011	4.80	< d
6	1.44	4.02	0.081	3.395	0.093	0.0196	0 00101	0 31	0 00014
7	0.07	0.76	0.019	0.005	0.002	0.0050	0.00010	3.01	< d
8	0.27	1.35	0.017	0 055	0.010	0.0065	0.00086	0.32	< d
9	0.16	0.08	0.005	0.010	0.002	0.0084	0 00012	0.09	< d
10	0.11	0.27	0.006	0.025	0 004	0 0031	0.00024	0.15	< d
11	0.29	0.78	0.016	0.048	0.009	0.0032	0.00095	0.42	< d
12	0.98	32 40	0.164	5 082	0.032	0.0252	0.00062	0.12	< d
13	0.13	0.55	0.004	0.016	0.003	0.0015	0.00011	0.42	< d
14	1 02	0.16	0.013	0.012	0.006	0.0010	0 00006	0.05	0.02300
15	1.06	2.30	0.027	0.014	0.016	0.0019	0.00006	0.67	0.00014
16	0.11	0.24	0.021	0.028	0.003	0.0023	0.00006	0 07	0.00007
17	0.15	1 04	0.009	0.016	0.004	0 0018	0.00009	0.29	< d
18	0.24	0 54	0.015	0.112	0.004	0 0020	0.00006	0.02	0 00014
19	0.44	1 15	0.010	0.011	0.004	0 0023	0.00016	0.42	< d
20	0 09	0.30	0 003	0.010	0.001	0 0006	0.00009	0.14	0.00012
21	0 06	0 05	0.002	0.019	0.001	0.0010	0 00011	0 07	< d
22	0.06	0 06	0 002	0 016	0.001	0.0006	0.00028	0.08	< d
23	0 46	2.19	0.011	0.062	0 001	0.0026	0.00027	0.56	< d
24	0.09	0.32	0.003	0 036	0.002	0.0038	0.00018	0 16	< d
25	0.10	1.15	0 017	0.253	0.097	0.0050	0.00885	13.00	< d
27	0.12	0 52	0.004	0.014	0.002	0 0014	0.00006	0.26	< d
30	0.14	0 65	0.004	0.055	0 003	0.0107	0.00085	0.28	< d
31	0.12	0.44	0.005	0.015	0.004	0.0008	0.00006	0.25	< d
32	0 14	0.62	0.004	0.022	0.004	0.0014	0 00010	0.32	0.00007
33	0.04	0.06	0.003	0.018	0.002	0 0003	0.00022	0.06	< d
34	0.04	0.05	0 004	0.004	0.003	0.0004	0 00008	0 09	< d
35	0 03	0 02	0.002	0.015	0 001	0.0005	0.00006	0.04	< d
36	0.39	0.55	0.010	0.054	0 008	0.0011	0.00006	0.27	0.00007
37	0.04	0 04	0.003	0.060	0.001	0 0118	0 00018	0.22	< d
38	0.05	0.06	0.003	0.042	0 003	0 0020	0.00006	0 45	< d
39	0.04	1.28	0.364	0.323	0.423	0.0211	0.06930	0.13	< d
40	0.11	2.39	0.114	0.218	0.033	0 0551	0.00157	1.85	< d
41	0 14	0 23	0 007	0.020	0.004	0 0007	0.00007	0.34	< d
42	0 08	0 44	0.012	0.036	0.012	0.0049	0.00084	0 31	< d
43	0.11	0.22	0.008	0.074	0.006	0.0028	0.00054	0 28	< d
44	0 07	0 11	0.006	0.027	0.004	0.0013	0.00023	0.19	< d
45	0.03	0.04	0.003	0.016	0 001	0.0026	0.00014	0.08	< d
46	0 03	0.08	0.030	0.058	0.022	0.0016	0.00184	0 08	< d
47	0.26	0.65	0 013	0.055	0.007	0 0025	0.00009	0.18	< d
48	0.28	3.62	0.004	0.001	0.005	0.0002	0.00006	0.01	< d
49	0.16	0.52	0.014	0.087	0.011	0.0028	0.00017	0.34	0.00007
50	0 14	0.22	0 010	0.043	0.006	0.0013	0.00006	0.13	0 00006
51	0.07	0.14	0.008	0.043	0.004	0.0017	0.00017	0.25	< d
52	0 14	0 32	0.023	0.113	0.003	0.0022	0.00019	0 19	0 00007
53	0.35	5.92	0.010	0.289	0.010	0.0009	0 00022	0.15	< d
54	0.16	0.23	0.006	0.005	0.006	0.0006	0.00006	0.45	0 00012
55	0.12	0 20	0 006	0.009	0.005	0.0004	0.00010	0 40	< d
56	0.10	0.12	0.010	0.026	0.008	0.0041	0.00012	0.17	< d
PDK-f	**0.01**	**0.10**	**0.001**	**0.010**	**0.025**				**0.00001**
PDK-s						**0.03**	**0.001**	**0.5**	

TABLE 4.13

CHLORORGANIC COMPOUNDS IN WATER SAMPLES (μg/l). Nizhni Novgorod and Samara provinces. July, 1993.

No	αHCH	βHCH	γHCH	ΣHCH	HCB	DDE	DDT	DBF
1{1}	traces	n.f.	n.f.	traces	0.0008	n.f.	n.f.	4
2{1}	n.f.	n.f.	n.f.	n.f.	0.0005	n.f.	n.f.	5.33
3{1}	0.0034	n f	n.f.	0.0034	0.0038	n.f.	n f	12.33
30	n f.	n.f	n.f.	n.f.	n.f.	n.f.	n.f	traces
46	0.1060	0.0490	0.0740	0.2290	0.0071	traces	n.f	n.f.
48	n.f.	n.f.	n.f.	n f.	n.f.	n.f.	n.f.	n f
49	1.0540	0.1990	0.2180	1.4710	0.0109	0.0980	n.f.	n.f.
50	-	-	-	-	n.f.	n f.	n.f.	traces
54	traces	n.f.	n.f.	n.f.	n.f.	n.f.	n f.	traces
PDK-f	-	-		0.01			-	1
PDK-s	-	-	4		50			

TABLE 4.14

BENZO(a)PYRENE IN WATER SAMPLES (ng/l). Nizhni Novgorod and Samara provinces. July, 1993.

No	B(a)P	No	B(a)P	No	B(a)P
1{1}	1 0	17	1.4	39	54.0
1{2}	1.4	18	1.0	40	100 0
2{1}	21.0	19	5 0	41	4 2
2{2}	2.0	20	3.2	42	35.0
3{1}	4.0	21	4.0	43	3 4
3{2}	1.8	22	1.4	44	4.0
4	23 0	23	2.4	45	3.2
5	30.0	24	16.4	46	2 8
6	27.0	27	1.4	47	3.4
7	4.2	30	5.0	48	2.6
8	27.0	31	1.4	49	2.0
9	1 0	32	0.8	50	2.4
10	4 4	33	0 6	51	11.8
11	35.7	34	1.6	52	10.0
12	50.0	35	2.2	53	7 6
13	1.4	36	8 0	54	2.2
14	3.4	37	3.2	55	1.2
15	2.0	38	1.6	56	34.0
16	0.4				
PDK-s	5	PDK-s	5	PDK-s	5

TABLE 4.15

MAH and PAHs IN WATER SAMPLES (ng/l). Nizhni Novgorod and Samara province. July, 1993.

No	Toluene	Naftalene	Fluorene	Fenan-threne	Antracene	FLT	Pyrene	B(a)P	BPL
6	1400	3200	40	136	77	d	400	10	5
8	d	d	d	d	13	d	d	11	6
12	12400	3600	96	440	40	d	800	30	18
56	12000	7000	30	d	d	d	d	15	10
PDK-s	500000	10000	-	-	-	-	-	5	-
S.w.	-	100	-	20	20	6	-	3	1

TABLE 4.16

BASIC CHEMICAL ANALYSIS OF WATER SAMPLES (μg/l). Nizhni Novgorod province. July, 1993.

No	pH	NO_3	NO_2	NH_4	PO_4	SPAV	Oil products
1{1}	8 6	1 75	0 030	0.35	0.127	n.f.	15.0
1{2}	8 3	1 90	0.029	0.35	0.126	n.f	9.2
2{1}	8.1	0.40	0.016	0.40	0.047	n f.	4 2
2{2}	8.0	0.54	0.015	0.45	0.034	n f	2 9
3{1}	8.4	1 95	0.037	0.43	0.122	0.03	1.3
3{2}	8 4	2 20	0.040	0.46	0.110	0.03	3.2
4	7 9	1.73	0 029	0.85	-	0.06	10.0
5	8 0	1.51	0.053	1.10	-	0.08	12.0
6	6.5	2.20	1.250	8.70	0.030	0.20	11 0
7	7.2	0.51	0.006	0.65	0 015	n.f.	2.7
8	7.5	0 11	0.032	0.69	0.210	0.07	4 9
9	7 8	0.62	0.006	0 40	0 018	0.09	11 0
10	8 0	1.81	0.150	5.70	0.039	0.05	2 4
11				Not analyzed			
12	6 3	64.00	5.590	11.70	0.016	0.14	2 9
13	8.4	1.83	0.037	0.36	0.121	0 03	0.5
14	7.8	0.10	0.046	9.50	0 046	0.80	1.04
15	9.6	0.26	0.090	18.00	0 033	1.48	1.3
16	8.0	3.20	0.900	34 00	0.235	0.13	1.6
17	8.4	1.50	0.390	4.40	0.147	0.13	0.3
18	7.4	0.50	0.012	0.30	0.036	0.12	0.8
19	7.8	0.25	0.065	2.30	0.182	0 10	0 5
20	7.9	0.50	0 024	0.50	0.006	0.14	1.0
21	8.2	0.30	0.015	0.30	0 005	0 07	0.6
22	8.1	0.29	0 016	0.35	0 005	0.10	3.6
23	7.0	2.00	0 018	42.50	0.008	0.10	1 0
24	8 6	1 10	0.032	0.15	0.144	0.09	0 3
27	8 5	1.00	0.033	0 20	0 150	0.09	0.4
28	7.8	150.00	n.f.	0.80	23.490	-	-
29	7.8	0.85	0.210	14 00	4.500	-	-
30	8.5	0.90	0.030	0.20	0.156	0.08	0.8
PDK-f	-6.58	9.1	0.02	0.5	0.25	1	0.05

TABLE 4.17

CHLORPHENOLS IN WATER SAMPLES (mg/l). Nizhni Novgorod province. July, 1993.

No	MCPh	DCPh	TCPh	PCPh	No	MCPh	DCPh	TCPh	PCPh
1{1}	$1\cdot10^{-2}$	$4\cdot10^{-5}$	$13\cdot10^{-5}$	$2\cdot10^{-6}$	16	n f	$5\cdot10^{-4}$	$5.2\cdot10^{-5}$	n.f.
2{1}	$18\cdot10^{-4}$	$9\cdot10^{-5}$	$34\cdot10^{-6}$	$4\cdot10^{-6}$	19	n.f	$4.3\cdot10^{-5}$	$4\cdot10^{-5}$	n.f.
3{1}	$1\cdot10^{-2}$	$1\cdot10^{-5}$	$58\cdot10^{-6}$	$9\cdot10^{-6}$	20	n.f.	$18\cdot10^{-6}$	$3\cdot10^{-5}$	n.f.
5	$5\cdot10^{-3}$	$4\cdot10^{-5}$	$6\cdot10^{-5}$	n f.	21	n.f.	n.f	$6\cdot10^{-6}$	n.f
9	n.f.	$4\cdot10^{-5}$	$1.4\cdot10^{-5}$	n.f.	22	n.f	$2\cdot10^{-5}$	$12\cdot10^{-6}$	n f.
10	$16\cdot10^{-4}$	$8\cdot10^{-5}$	$63\cdot10^{-6}$	$3\cdot10^{-6}$	23	$35\cdot10^{-4}$	$2\cdot10^{-5}$	$10\cdot10^{-6}$	n f.
11	$3\cdot10^{-4}$	n.f	$14\cdot10^{-6}$	$1\cdot10^{-6}$	27	$5\cdot10^{-3}$	$2\cdot10^{-5}$	$9\cdot10^{-6}$	$3\cdot10^{-6}$
14	$3\cdot10^{-4}$	$4\cdot10^{-4}$	$4\ 3\cdot10^{-4}$	n.f.	30	$2\cdot10^{-3}$	$1\cdot10^{-5}$	$4\cdot10^{-5}$	n.f
15	n.f.	$3\cdot10^{-3}$	$2\cdot10^{-4}$	n.f.	31	$3\cdot10^{-3}$	n f	$7\cdot10^{-6}$	n f
PDK-s	$1\cdot10^{-3}$	$2\cdot10^{-3}$	$4\cdot10^{-3}$		PDK-s	$1\cdot10^{-3}$	$2\cdot10^{-3}$	$4\cdot10^{-3}$	
PDK-f				$5\cdot10^{-3}$	PDK-f				$5\cdot10^{-3}$
S.w.	$2.5\cdot10^{-4}$	$8\cdot10^{-5}$	$2.5\cdot10^{-5}$	$2\cdot10^{-6}$	S.w.	$2.5\cdot10^{-4}$	$8\cdot10^{-5}$	$2.5\cdot10^{-5}$	$2\cdot10^{-5}$

TABLE 4.18

WATER SAMPLES Nizhni Novgorod province. September, 1993.

No	Site location	Date
1	Mouth of the Volosyanikha canal, city of Dzerzhinsk	8.09.93
2	Canal Volosyanikha, 2-nd production site of Synthez, city of Dzerzhinsk	8.09.93
3.	Drinking water of Dzerzhinsk.	8.09.93
4	Discharge canal of Sverdlov plant, city of Dzerzhinsk	8.09.93
5.	Discharge of drinking water facility, city of Balakhna	9.09.93
6.	River Volga in the area of discharge of the sewage treatment plant of Balakhna.	9.09.93
7.	River Volga, downstream of the settlement of Bezvodny (in the area of the discharge of the district sewage treatment plant of the city of Dzerzhinsk).	9.09.93
8.	Discharge of the oil refinery (NPZ) of the city of Kstovo city. (Pipe rupture.)	9.09.93
9.	Discharge of sewage treatment plant of Nizhni Novgorod.	9.09.93
10.	Mouth of the Zapadno-Strelochny Canal, Nizhni Novgorod.	10.09.93
11	.Mouth of the Dizel plant canal Nizhni Novgorod	10.09.93
12	Mouth of the river Rzhavka, Nizhni Novgorod	10.09.93
13.	River Rzhavka, in the area of Etna plant, Nizhni Novgorod	10.09.93
14.	Mouth of Levinka river, Nizhni Novgorod	10.09.93
15.	Drinking water, Nizhni Novgorod (Oka river water intake)	11.09.93
16.	Drinking water, Nizhni Novgorod (Volga river water intake)	11 09 93

TABLE 4.19

METALS IN WATER SAMPLES (mg/l). Nizhni Novgorod province. September 1993.

No	Fe	Mn	Cu	Zn	Al	Cr	Pb	Cd	As	Hg
1	0.24	0.750	0.006	0.035	0.03	0.0040	0.0004	< d	0.005	0.00005
2	2 56	0.770	0.009	0.007	0.12	0.0050	0.002	< d	0.018	0 00005
3	0.24	0.050	0.014	0.020	0.35	0.0020	0.001	< d	< d	< d
4	0.20	0.350	0.005	0.005	0.36	0.0030	0.002	< d	0.005	< d
6	0.58	0.265	0.007	0.092	0.14	0.0030	0.001	0.00074	< d	< d
7	1.98	0.575	0.008	0 107	0.60	0.0090	0.003	0.00035	< d	< d
8	0.30	0.050	0.002	0.012	0.04	0.0009	0.001	0.00053	< d	< d
9	0.36	0.245	0.010	0.017	0.10	0.0030	0.0006	0.00022	0 002	< d
10	0 30	0.130	0.004	0.230	0.017	0.0020	0.0027	0 00018	< d	< d
11	2.50	0.890	0.014	0.040	435.00	0.0100	0.001	0.00007	0.038	0.00260
12	1.76	0.235	0.017	0.012	0.90	0.0050	0.017	0.00016	0.004	0 00010
13	18.20	1.000	0.080	0.557	0.12	0 1030	0.0025	0.00015	< d	0.00005
14	105 00	1 550	0.650	13.125	0.64	1.2500	0.030	0 00132	< d	< d
15	0.54	0.155	0 007	0.012	0.25	0.0030	0.001	0.00039	< d	0.00005
16	0 14	0.055	0.003	0.004	0.58	0.0030	0.0003	0.00024	0.002	0.00005
17	0.24	0.055	0.003	0.025	0.19	0.0020	0.0001	< d	< d	< d
PDK-f	**0.1**	**0.01**	**0.001**	**0.01**	-	**0.0250**			**0.05**	**0.00001**
PDK-s					**0.5**		**0.03**	**0.001**		

TABLE 4.20

PAHs IN WATER SAMPLES (ng/l). Nizhni Novgorod province. September 1993

No	Toluene	Naftalene	Fluorene	Fenan-threne	Antracene	FLT	Pyrene	B(a)P	BPL
6	-	924	126	1785	170	1190	800	24	20
7	9080	3740	1400	1090	500	670	-	d	d
8	-	1110	-	1090	1300	690	-	d	d
9	19150	5140	320	1180	135	-	-	d	d
10	-	3530	65	1490	-	-	-	32	20
11	-	-	-	590	-	830	-	d	d
12	7240	2070	-	1110	-	1860	-	d	d
13	2780	-	800	-	-	1860	-	d	d
14	6840	1340	-	930	-	-	-	19	15
15	d	d	-	-	-	260	-	d	d
16	-	-	-	310	-	-	-	8	d
17	1770	210	40	280	-	230	190	5	d
PDK-s	**500000**	**10000**						5	
S.w.		**100**	-	**20**	**20**	**6**	-	**3**	**1**

TABLE 4.21

BENZO(a)PYRENE IN WATER SAMPLES (ng/l). Nizhni Novgorod province. September 1993.

No	B(a)P	No	B(a)P	No	B(a)P	No	B(a)P
6	27.0	9	8.4	12	5.6	15	4 0
7	2.1	10	39.0	13	4.0	16	12 0
8	8.3	11	2.7	14	24.0	17	7.2
PDK-s	5	PDK-s	5	PDK-s	5	PDK-s	5

TABLE 4.22

SEDIMENT SAMPLES NIZHNI NOVGOROD AND SAMARA PROVINCES, AND KUIBYSHEVSK WATER RESERVOIR.
July-August, September and October, 1993.

No.	Site location	Depth (m)	Date
	NIZHNI NOVGOROD PROVINCE		
4-N	Mouth of Zapadno-Strelochny Canal Nizhni Novgorod.	0 30	15.07.93
5-N	Mouth of Dizel plant Canal. Nizhni Novgorod.	0.30	15.07 93
6-N	Mouth of river Rzhavka. Nizhni Novgorod	0.30	15.07.93
7-N	Mouth of river Chernaya. Nizhni Novgorod.	0.30	15.07 93
8-N	Mouth of river Levinka. Nizhni Novgorod.	0.40	15.07.93
9-N	Burnakovskaya Flood Plain. Nizhni Novgorod.	0.10	15.07.93
11-N	Mouth of river Rakhma. Nizhni Novgorod.	0.40	15 07.93
12-N	River Rzhavka, at discharge of Etna plant. Nizhni Novgorod.	0.40	15.07.93
2-D	Volosyanikha Canal. 2nd production site of Synthez. Dzerzhinsk.	0.40	5.10.93
14-D	Mouth of Volosyanikha Canal. Dzerzhinsk.	0.30	19.07 93
1-D	Mouth of Volosyanikha Canal. Dzerzhinsk.	0.30	5.10.93
15-D	Middle of Volosyanikha Canal. Dzerzhinsk.	0.50	19.07.93
17-D	Mouth of Dzerzhinsk Heat & Power Plant Canal. Dzerzhinsk.	0.30	19.07 93
19-D	River Pyra at discharge from Sverdlov plant. Dzerzhinsk.	0.30	19.07.93
24-P	River Oka, upstream of city of Pavlovo.	11.00	22.07 93
25-P	Mouth of Tarka river. City of Pavlovo.	10 00	22.07.93
29-V	End of Seima Canal. City of Volodarsk.	3.00	22.07.93
7-B	Mouth of river Parasha. City of Balakhna.	3.00	20.09 93
	SAMARA PROVINCE		
33-S	Volga river, 100 m downstream of the mouth of the river Mokrets. City of Samara.		26.07 93
34-S	Mouth of the river Sok. Samara.	0.30	26.07.93
36-S	Discharge of Elektroshchit plant. City of Samara.	0.30	26.07.93
41-42-S	Lake Krasnoye, left bank. City of Samara.	0.50	27.06.93
43-S	Mouth of Krasnoye lake. City of Samara.	3.00	27.06.93
47-Ch	Otvodnoi Canal, 200 m from confluence with river Chapaevka. City of Chapaevsk.	0.50	29 07 93
48-Ch	Disconnected part of the river Chapaevka. City of Chapaevsk.	0.30	29.07.93
49-Ch	Mouth of Otvodnoi Canal. City of Chapaevsk.	1.20	29.07 93
50-Ch	River Chapaevka, 1 km downstream of Otvodnoi Canal.	3.50	29.07.93
51-NK	River Krivusha, downstream of discharge of the city of Novokuibyshevsk.	7.00	29 07.93
53-NK	Settling pond of the Heat and Power Plant-1. City of Novokuibyshevsk.	0 30	29.07 93
54-O	River Bolshoi Kinel, drinking water intake. City of Otradny.	0.30	30.07 93
55-O	River Bolshoi Kinel, downstream of discharge of the sewage treatment plant. City of Otradny.	0 30	30 07.93
	KUIBYSHEVSK WATER RESERVOIR		
11-K	Village Burtasy, 1 km from the right bank.	16 00	2.08.93
	35 km downstream of the city of Kazan.	8 00	
10-K	Village Mordovski Karatai, 1 km from the right bank.	15.00	2.08.93
9-K	1 Km upstream of the city of Ulyanovsk, 1 km from the right bank.	20.00	1.08 93
8-K	5 Km downstream of the city of Ulyanovsk, 1 km from the right bank.	18.00	1.08.93
7-K	Sengiley Bay, 1 km from the right bank.	8.50	1 08 93
2-K	The mouth of the Cheremshanski Bay, 2 km from the right bank.	16.00	26.07.93
1-K	Settlement of Russkaya Bektyashka, 1 km from the right bank.	11.00	26.07.93
3-K	Settlement of Novodevichye, 1 km from the right bank of the Volga.	16 00	27.07 93
4-K	Settlement of Usolye, 1 km from the right bank	14.00	28.07.93
5-K	Opposite of the mouth of the Usinsk Bay, 1 km from the right bank of the Volga	19.00	28.07.93
6-K	2 km upstream of the dam.	20.00	28.07.93

TABLE 4.23

POLLUTION OF SEDIMENT SAMPLES IN RELATION TO STANDARDS. Nizhni Novgorod Province.

No.	SPZ1 / SPZ2	Exceeding rate of standards I group	Exceeding rate of standards II group	Exceeding rate of standards III group
		EXTREMELY DANGEROUS LEVEL OF POLLUTION		
4-N	37 / 317	Ni (1.93) - Cr (2.97) - As (3.75) - Hg (3.0) - Cd (28.8)	phenols (2.2) - oil-products (278.0)	MAH: toluene (12.0); PAHs: naftalene (9.0) - fenanthrene (3.0) - pyrene (5.0) - benzoperylene (200.0) Chlororganic compounds (COC): no data.
12-N	39 / 109	As (1.2) - Hg (4.0) - Cd (35.0) - Pb (1.33)	ammonium nitrogen (2.7) - nitrates (8.46) - phenols (2.2) - oil-products (278 0)	MAH: toluene (26.0); PAHs: naftalene (9.0) - fenanthrene (4.0) - fluoranthene (67.0) - benzo(a)pyrene (12.0) - benzoperylene (128.0) COC: no data.
1-D; 14-D	39 / 73	Ni (1.51) - Cr (2.24) - Pb (1.86) - Hg (3.0) - Cd (34.5)	ammonium nitrogen (2.58) - nitrates (7.69) - phenols (14.5) - oil-products (48.6)	COC: DDT (17929) - PCBs (703) - HCB (37) MAH and PAHs: no data.
15-D	17 / 232	As (2.69) - Hg (2.0) - Cd (14.1) - Pb (1.44)	ammonium nitrogen (5.14) - nitrates (12.31) - phenols (19.6) - oil-products (181.5)	MAH: toluene (73.0); PAHs: naftalene (8.2) - fluoranthene (2.9) COC: α-HCH (1) - DDT (19) - DBF (12)
17-D	14 / 216	Cd (14.1)	ammonium nitrogen (5.0) - nitrates (10.8) - phenols (19.9) - oil-products (170.2)	MAH: toluene (10.0); PAHs: naftalene (4.7) - fenanthrene (30) - fluoranthene (16.1) - benzo(a)perylene (32.1) - fluorene (10 mg/kg) COC: α-HCH (1) - β-HCH (1.8) - γ-HCH (20) - DDT (3) - DBF (46) - PCBs (32)
5-N	14 / 85	Hg (2.0) - Cd (13.1)	ammonium nitrogen (2.9) - nitrates (9.23) - phenols (13.9) - oil-products (49.18)	MAH: toluene (2630); PAHs: antracene (2.5) - fenanthrene (11.0) - pyrene (115.0) - benzo(a)pyrene (2.0) - benzoperylene (794.0) COC: no data.
6-N	20 / 84	As (1.2) - Hg (5.0) - Cd (14.9) - Pb (1.46)	ammonium nitrogen (2.71) - nitrates (8.46) - phenols (12.34) - oil-products (47.4)	MAH: toluene (38.0); PAHs: naftalene (15.0) - fenanthrene (5.0) - fluorene (30 mg/kg) - benzo(a)pyrene (9.0) - fluoranthene (821.0) - benzoperylene (1620.0) COC: no data.
11-N	25 / 76	Cd (25.0)	ammonium nitrogen (1.35) - nitrates (3.85) - phenols (12.2) - oil-products (37.4)	PAHs: naftalene (3.0) - pyrene (2.0) - benzoperylene (24.0) COC: no data.
		DANGEROUS LEVEL OF POLLUTION		
9-N	44 / 103	As (1.12) - Cd (43.5)	ammonium nitrogen (2.67) - nitrates (8.64) - phenols (9.4) - oil-products (42.0)	PAHs: no data. COC: no data.
8-N	30 / 80	Hg (6.0) - Cd (25.4)	ammonium nitrogen (2.66) - nitrates (7.69) - phenols (7.72) - oil-products (35.8)	PAHs: no data. COC: no data
19-D	32 / 113	Pb (1.46) - Hg (8.0) - Cd (24.6)	ammonium nitrogen (4.29) - nitrates (10.0) - phenols (16.7) - oil-products (54.0)	PAHs: benzo(a)pyrene below standard, no other data. COC: no data.
2-D	31 / 54	As (5.10) - Hg (1.5) - Cd (24.5) - Ni (1.78) - Cr (2.58)	nitrates (3.27) - phenols (2.6) - oil-products (19.2)	PAHs: no data. COC: no data.
25-P	85 / 147	As (2.87) - Hg (2.0) - Cd (81.7) - Pb (1.21)	phenols (15.0) - oil-products (40.0)	PAHs: no data. COC: no data.
		MODERATELY DANGEROUS LEVEL OF POLLUTION		
24-P	9 / 70	Hg (7.0) - Cr (1.45) - As (2.15) - Cd (1.2) - Pb (1.18)	ammonium nitrogen (3.35) - nitrates (8.46) - phenols (14.66) - oil-products (38.2)	PAHs: no data. COC: no data.
29-V	6 / 55	Hg (2.0) - Cd (5.0)	ammonium nitrogen (2.3) - nitrates (8.0) - phenols (11.6) - oil-products (32.4)	PAHs: no data. COC: no data.
7-B	12 / 71	Ni (2.17) - Hg (2.0) - Cd (6.2) - Pb (1.7) - Cr (4.0)	nitrates (4.0) - phenols (9.8) - oil-products (48.2)	PAHs: no data. COC: no data.
7-N	14 / 73	Ni (2.4) - Hg (5.0) - Cd (5.1) - Pb (1.64) - Cr (4.1)	ammonium nitrogen (3.0) - phenols (8.5) - oil-products (50.5)	PAHs: no data. COC: no data.

TABLE 4.24

POLLUTION OF SEDIMENT SAMPLES IN RELATION TO STANDARDS. Samara Province.

No.	SPZ1 / SPZ2	Exceeding rate of standards I group	Exceeding rate of standards II group	Exceeding rate of standards III group
		EXTREMELY DANGEROUS LEVEL OF POLLUTION		
43-S	44 / 68	Ni (1.41) - Cr (2.49) - As (2.65) - Hg (5.0) - Cd (34.9) - Pb (2.22)	---	PAHs: naftalene (4.1) Chlororganic compounds (COC): DDT (5.9) - PCB (17.5) - DBF (8 2)
48-Ch	13 / 209	---	nitrates (2.95) - phenols (12.40) - oil-products (182.4)	PAHs: benzo(a)pyrene below standard. No other data. COC: α-HCH (2524) - β-HCH (7738) - γ-HCH (638610) - DDT (6223) - HCB (7143) - DBF (1618)
49-Ch	7 / 47	---	nitrates (5.38) - phenols (6.44) - oil-products (30.54)	PAHs: benzo(a)pyrene below standard. No other data. COC: α-HCH (46) - β-HCH (174) - γ-HCH (770) - DDT (4461) - HCB (985) - DBF (3116)
50-Ch	120 / 341	Pb (2.1) - Ni (2.64) - As (3.0) - Cr (4.37) - Cd (112.3)	ammonium nitrogen (2.7) - nitrates (9.23) - phenols (24.5) - oil-products (175.0)	PAHs: benzo(a)pyrene below standard. No other data. COC: α-HCH (14) - β-HCH (11.3) - γ-HCH (3735) - DDT (358) - HCB (8.1) - DBF (49)
51-NK	10 / 234	---	ammonium nitrogen (2.9) - nitrates (10.0) - phenols (25.74) - oil-products (189.7)	PAHs: naftalene (5.3) - fenanthrene (11.0) - fluorene (40 мg/kg) - fluoranthene (80.0) - benzo(a)pyrene (18.0) - benzoperylene (15.0) - pyrene (18.0) - antracene (3.0) COC: DDT (56.0) - DBF (142)
53-NK	2 / 51	---	nitrates (6.15) - phenols (18.9) - oil-products (27.4)	MAH: toluene (35.0); PAHs: naftalene (2.4) - fenanthrene (1.9) - pyrene (2.4) - benzo(a)pyrene (4.2) - benzoperylene (6.7) - fluorene (30 мg/kg) - fluoranthene (84.4) COC: no data.
		DANGEROUS LEVEL OF POLLUTION		
43-S	102 / 131	Cd (101.3) - Pb (1.32)	---	PAHs: no data. COC: no data.
47-Ch	114 / 180	Pb (2.21) - Ni (1.41) - As (2.82) - Cr (2.49) - Cd (108.7)	nitrates (6.15) - phenols (6.8) - oil-products (34.1)	PAHs: benzo(a)pyrene below standard. No other data. COC: no data.
54-O	111 / 216	Pb (1.63) - Ni (1.38) - As (2.82) - Hg (7.0) - Cd (101.0)	ammonium nitrogen (31.8) - nitrates (10.0) - phenols (16.3) - oil-products (39.1)	PAHs: benzo(a)pyrene below standard. No other data. COC: not found.
		MODERATELY DANGEROUS LEVEL OF POLLUTION		
41-42-S	23 / 46	Pb (2.43) - As (1.6) - Hg (4.0) - Cd (17.8)	nitrates (3.0) - phenols (3.1) - oil-products (16.8)	PAHs: benzo(a)pyrene below standard. No other data. COC: no data.
55-O	15 / 57	Pb (3.4) - Ni (2.41) - Hg (8.0) - Cr (4.1)	nitrates (6.2) - phenols (13.8) - oil-products (25.4)	PAHs: benzo(a)pyrene below standard. No other data. COC: no data.

TABLE 4.25

POLLUTION OF SEDIMENT SAMPLES IN RELATION TO STANDARDS. Kuibyshev water reservoir.

No.	SPZ1 / SPZ2	Exceeding rate of standards I group	Exceeding rate of standards II group	Exceeding rate of standards III group
		DANGEROUS LEVEL OF POLLUTION		
8-K	17 / 50	Hg (3 0) - Cd (14.9)	nitrates (4.6) - phenols (10.8) - oil-products (21.3)	PAHs. naftalene (5.2) Chlororganic compounds (COC): DDT (7)
7-K	15 / 78	Hg (2 0) - Cd (14.0)	ammonium nitrogen (1.95) - nitrates (5.38) - phenols (15 0) - oil-products (46.0)	PAHs: naftalene (6.2) - fluoranthene (1.5) COC: β-HCH (1 2) - DDT (4) - DBF (6 7)
2-K	16 / 32	Hg (3 0) - Cd (13.7)	---	PAHs. below standards. COC: DDT (11)
1-K	21 / 38	Ni (1.47) - As (1.14) - Cr (1.84) - Cd (13.9) - Hg (7.00)	---	PAHs: below standards COC. DDT (2) - DBF (10)
5-K	14 / 61	---	ammonium nitrogen (1.7) - nitrates (5.38) - phenols (10 6) - oil-products (33.8)	MAH: toluene (7.0); PAHs: naftalene (4) - fenanthrene (1.8) - fluoranthene (27) - benzoperylene (791) COC. DDT (3 5)
6-K	13 / 35	---	---	MAH: toluene (135.0); PAHs: fenanthrene (3 4) - pyrene (8.0) - benzoperylene (1384) COC: DDT (11) - DBF (8) - β-HCH (1 2)
		MODERATELY DANGEROUS LEVEL OF POLLUTION		
11-K	11 / 34	---	---	PAHs. fenanthrene (1.8) - fluoranthene (1.1) COC. DDT (11)
10-K	8 / 34	---	---	PAHs· fenanthrene (1 1) COC: DBF (17.3)
9-K	7 / 19	---	---	PAHs: naftalene (5.4) COC DBF (8 6)
3-K	10 / 59	---	ammonium nitrogen (2 17) - nitrates (6 15) - phenols (13.0) - oil-products (31.6)	PAHs· benzoperylene (1) COC· DDT (2) - DBF (19)
4-K	13 / 59	---	ammonium nitrogen (1.5) - nitrates (5 38) - phenols (10.4) - oil-products (32 2)	PAHs· naftalene (2) COC. DDT (5)

TABLE 4.26

HEAVY METALS AND OTHER COMPOUNDS IN SEDIMENT SAMPLES (mg/kg). Nizhni Novgorod Province (factual and calculated data).

No	Percentage of lutum particles <0 002 mm	Percentage of organic matter	Cd		Cu		Ni		Cr		Pb		As		Hg		Zn		PO_4	NO_3	NO_2	NH_4	Oil-products	Phenols
			fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	fact.	fact.	fact.	fact.	fact.
4-N			2.88		3.10		32.86		65.31		12.96		15.00		0.30		10.00		30.00	100.00	0 10	12.70	13895.00	0.110
5-N			1.31		6.30		0.70		1.20		5.73		2.10		0.20		17 40		420.00	1200.00	1.00	268.00	2459.00	0 695
6-N			1.49		12 20		3.34		7.80		16 34		4 80		0.50		31.00		350.00	1100.00	0.90	251 00	2370.00	0.617
7-N			0 51		13.50		40 88		90.10		18 36		2.30		0.50		33.00		20.00	100 00	0.10	281.00	2527.00	0.426
8-N			2.54		5.40		4.22		10.40		7.50		2.70		0 60		14.00		370.00	1000.00	0 80	246.00	1790.00	0 386
9-N			4.35		6.10		5.60		10.75		10.11		4.50		0.10		20.00		350.00	1100.00	0.80	247.00	2100.00	0.470
11-N			2.50		4.30		0.50		1.50		5 90		1.40		0 10		12.00		150.00	500.00	0.40	125.00	1870.00	0.610
12-N			3.50		8.80		8.16		20.20		14 84		4.80		0.40		25 40		380.00	1100.00	0.90	249 40	2420.00	0.775
2-D			2.45		7.66		30 21		56 81		10.75		20.40		0 15		14.20		220 00	425.00	0.50	32.80	960 00	0.130
14-D	1.50		0.34	0.65	1.00	2.26	0.22	0.67	1.64	3.09	10 80	17 83	1.00	1.86	0.10	5.10	16.80	43 16	330.00	1000.00	0.80	239.00	2430.00	0.724
1-D			3 45		8 10		25.61		49.30		20 80		2 11		0.30		16.11		202.00	391.00	0.50	28 10	835.00	0.610
15-D	6.50	13.00	1.41	1.54	2.80	3.78	1.66	3 52	2.38	3 78	16 18	19.79	10 75	13 67	0.20	0 15	9.00	14.16	510.00	1600.00	2 00	475 00	9075.00	0 980
17-D	4.40	7.00	1.41	1.92	4 70	7.74	1.84	4 47	4.70	7.99	7.77	10.76	1.36	2.00	0.10	0.14	12.00	22 80	490.00	1400	2.00	470.00	8510 00	0 995
19-D	7.60	18 00	2 46	2.32	9.30	11 03	4 88	9 70	10.40	15.95	16.39	18 43	2.90	3 33	0.80	0 45	27.00	37.88	430 00	1300 00	1.00	396.50	2700.00	0.837
24-P	2 00		0.12	0.22	3.20	7.11	10 12	29 52	31 80	58 89	13 18	21 54	8.45	15 51	0.70	35 70	9.00	22.50	360.00	1100 00	1 00	310.00	1910.00	0.733
25-P	4.90	15.00	8.17	8.56	2 50	3.34	1.50	3 52	2.96	4.95	13 54	16.46	11 47	14 49	0 20	0.13	7.00	11 24	350 00	1100 00	1.00	290.30	2000.00	0 750
29-V	6.70	15.00	0.50	0.52	5 30	6 81	8 02	16.81	17 05	26.89	12 80	15.17	4 51	5 52	0 20	0 13	14 00	21.17	240 00	800.00	0.80	210.80	1620 00	0.582
7-B			0.62		4 30		36.82		88.12		19 02		2 24		0 20		10.30		329 00	510 00	0.75	56.20	2410 00	0 490

TABLE 4.27 HEAVY METALS AND OTHER COMPOUNDS IN SEDIMENT SAMPLES (mg/kg). Samara Province (factual and calculated data).

No	Percentage of lutum particles <0.002 mm	Percentage of organic matter	Cd		Cu		Ni		Cr		Pb		As		Hg		Zn		PO_4	NO_3	NO_2	NH_4	Oil-products	Phenols
			fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	fact.	fact.	fact.	fact.	fact.
33-S	0.60		0.10	0.19	3.60	8.44	5.60	18.49	10.26	20 40	7.66	12.87	1.30	2.47	0.30	15 30	10.00	27.03	60.00	200.00	0.20	27 60	545 00	0.060
34-S	1 40		0.10	0.19	3 8	8.64	2.60	7 98	5.12	9 70	12 30	20.34	1.35	2.52	0.10	5.10	9.00	23.25	10.00	200.00	0 20	29.00	570.00	0 075
36-S	0.90	8.00	10 13	13.85	6.10	6.12	1.48	4 75	4 20	8 11	14 75	21.29	4.50	7 03	0.10	0 12	17 00	36.79	200.00	300.00	0.20	32.50	600 00	0.077
41-42-S	7.00	21.00	1.78	3.40	7.40	16 69	6 92	20.88	15.30	28.76	27 23	44 86	6.40	11.87	0.40	20 40	22.00	56 20	200.00	400.00	0.30	48.00	839.00	0 155
43-S	12 10	14.00	3.49	3.52	3.80	2.59	23 92	37.88	54.80	73 85	24.87	27 78	10 61	12.09	0.50	0.36	20 60	26.88	200.00	400.00	0.30	49.10	890.00	0.156
47-Ch	8.20		10 87	18.66	4.30	7.77	23 90	45.96	54.80	82.53	24 80	36.20	11.29	17 91	0.10	5 10	13 00	24 40	240 00	800.00	0.60	73.50	1706.00	0.340
48-Ch	1.60		1.15	2.20	2.31	5.21	16.40	49.48	38.15	71 71	14.20	23.39	2.95	5 47	0.10	5 10	20.05	51 22	311.00	384.00	0.30	26.50	9120.00	0.620
49-Ch	2.10		0.50	0.95	4.90	10.85	4 26	13 32	10.30	19.00	13.30	21.70	1 40	2.56	0.30	15 30	13 00	32.32	210.00	700 00	0.60	68.00	1527 00	0.322
50-Ch	3 10	17 00	11.23	11 32	5.10	4.18	44 90	119.9	96 11	171.01	23 87	28.94	12.20	15.36	0.10	0.06	14.00	23.11	400.00	1200.00	1 00	250.00	8750.00	1.226
51-NK	15.70	17.00	0.10	0 09	9.30	5 67	22.82	31.10	50 80	62 41	23.45	24.10	1 67	1 72	0 70	0.42	39.00	44.54	420.00	1300.00	2 00	265.00	9487.00	1.287
53-NK	2.40	35.00	0.10	0.07	6.70	4.48	1 80	5.08	3 90	7 12	12.98	12.62	5 70	5.52	0 10	0 03	18 00	22.97	230 00	800.00	0 60	68 70	1370 00	0 945
54-O	15.00	14.00	10 10	9 92	3.80	2 43	23 46	32.84	50 61	63.26	18 23	19 60	11 29	12 31	0.70	0.50	9 00	10 86	450 00	1300.00	0 20	294 00	1955 00	0.817
55-O	9.00	13.00	0.10	0 11	10 40	7 70	40 98	75.49	90.40	132.9	37.93	44.79	1 55	1 89	0.80	0.62	26 50	38.45	230 00	800.00	0 80	70 50	1268.00	0 690

TABLE 4.28 HEAVY METALS AND OTHER COMPOUNDS IN SEDIMENT SAMPLES (mg/kg). Kuibyshev water reservoir (factual and calculated data).

No	Percentage of lutum particles <0 002 mm	Percentage of organic matter	Cd		Cu		Ni		Cr		Pb		As		Hg		Zn		PO_4	NO_3	NO_2	NH_4	Oil-products	Phenols
			fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	calc.	fact.	fact.	fact.	fact.	fact.	fact.
11-K	4.60	5 00	1.06	1.55	2.10	3.21	10 18	24 40	19 20	32 43	9.34	13.30	2 21	3.40	0.10	0 20	8 00	15.71	150 00	500.00	0,20	33,20	735.00	0,410
10-K	18.00	14.00	0.83	0.79	4.42	3,54	6.75	8.44	16 80	19.53	8 70	9 02	1.51	1.58	0.10	0.07	13.11	14.68	600 00	300.00	0.30	29.40	785.00	0 550
9-K	21.10	11.00	0.69	0 70	6 30	4.83	0 74	0.83	1 40	1 52	4 90	5.07	1.47	1.53	0 10	0.09	15 00	16.18	60.00	200.00	0.10	15.00	490,00	0.220
8-K	31 10	14 00	1.49	1 28	6.70	3.97	0.76	0.65	1 26	1 12	9 05	8.09	1.41	1.24	0.30	0.22	13.00	11 08	200.00	600.00	0.50	59 40	1065.00	0 540
7-K	20 50	14.00	1.40	1,31	5 50	4.13	9.28	10 65	20 14	22.13	12.62	12.69	1 40	1.41	0 20	0 14	16.00	16.90	210 00	700.00	0.80	180.40	2300 00	0.750
2-K	47 20	16 00	1 37	0.98	17 30	11.69	8 62	5 27	15 31	10 60	12 98	9.75	2 25	1.62	0 30	0.19	38 00	24 68	200 00	600.00	0 40	55.30	657.00	0 030
1-K	16 80	11 00	1.39	1 41	9 60	10.66	24 92	32 54	40 56	48 52	11 98	13.09	4 55	5 05	0 70	0 64	33.40	40 00	200.00	600.00	0.40	50.00	630.00	0 031
3-K	20 10	12.00	0.96	0 92	7 00	7.36	5 64	6 56	9.84	10 90	16 41	16.99	2.35	2.45	0 10	0 08	21.00	22 92	300.00	800 00	0 60	201.12	1580.00	0.650
4-K	33 20	17 00	1 30	1.00	7 00	5.59	2 84	2 30	5 60	4 81	15 02	12.74	1 13	0.93	0 10	0 06	20.00	16 00	210 00	700 00	0.60	139 00	1610 00	0.520
5-K	33 30	16 00	1 34	1 00	5 90	4.76	5.02	4 06	9.23	7 92	13 91	11 90	1 50	1 25	0 10	0 06	22 40	18.03	210 00	700.00	0 60	157 00	1690 00	0 530
6-K	44 50	17 00	1 22	0 90	6 10	4 23	1 30	0 83	3 40	2 45	14 56	11 10	1 55	1 14	0 10	0 06	15 70	10 52	160 00	500 00	0 40	49 30	710 00	0 350

TABLE 4.29

CHLORORGANIC PESTICIDES IN SEDIMENT SAMPLES (mg/kg) (calculated data)

No	α-HCH	γ-HCH	β-HCH	HCH	p"p-DDE	o"p-DDT	p"p-DDD / p"p-DDT	DDT
				KUIBYSHEV WATER RESERVOIR				
1-K	0 00046	n.f.	0 00073	0.0012	0.0006	traces	0.0051	0.0052
2-K	sulphur	sulphur	traces	traces	0.002	0 0138	0.0295	0.0285
3-K	0 0004	n.f.	0.0008	0.0012	0 0012	n.f.	0.0055	0 0053
4-K	sulphur	sulphur	traces	traces	traces	n.f	0 0205	0 0121
5-K	sulphur	sulphur	sulphur	sulphur	sulphur	sulphur	0.014	0.0088
6-K	traces	traces	0.0012	0.0012	0.0012	0.0116	0.032	0 0270
7-K	0.0008	traces	0.0012	0.0020	0.0013	0.0006	0.0128	0.0104
8-K	sulphur	sulphur	traces	traces	0.0021	traces	0 0179	0.0143
9-K	0.0012	n.f.	traces	0.0012	traces	traces	traces	traces
10-K	0.0008	traces	traces	0.0008	traces	n f	traces	traces
11-K	sulphur	sulphur	traces	traces	0.0011	traces	0 0114	0 0250
				SAMARA PROVINCE				
34-S	sulphur	n.f.	traces	traces	n.f.	n f	traces	traces
43-S	traces	n.f	n.f	traces	n f.	n f.	0.0209	0.0149
48-Ch	6.3105	319305	7.738	9.1958	1.0328	0.8738	1.2052	15.559
49-Ch	0 117	0.0385	0.1745	0.0660	0.0325	1 0918	1.1065	11.154
50-Ch	0.0373	0.1362	0.0113	0.3144	0 0555	1.1428	0.4397	0 9653
51-NK	traces	traces	n.f.	traces	0.0091	0 1038	0.1262	0.1406
				NIZHNI NOVGOROD PROVINCE				
14-D	n.f	n.f.	n.f.	n.f.	0.3626	3.465	5.137	44 823
15-D	0.0027	n.f.	traces	0.0035	0.0019	0.031	0.0285	0.0479
17-D	0.0046	0 0001	0.0018	0.0052	n.f.	n.f	0.0054	0.0077

TABLE 4.30

CHLORORGANIC COMPOUNDS IN SEDIMENT SAMPLES (mg/kg) (calculated data)

No	HCB	PCBs	DBF
	KUIBYSHEV WATER RESERVOIR		
1-K	0.0001	n.f.	1.015
2-K	sulphur	n f.	sulphur
3-K	0.0002	n.f.	1.962
4-K	sulphur	n f	sulphur
5-K	sulphur	n.f.	sulphur
6-K	0 0005	n.f	0.8024
7-K	0.0015	n f.	0.6757
8-K	sulphur	n f.	sulphur
9-K	0.0012	n.f.	0.8627
10-K	0 0012	n.f.	1.733
11-K	sulphur	n.f.	sulphur

No	HCB	PCBs	DBF
	SAMARA PROVINCE		
34-S	sulphur	n.f.	6.035
43-S	0.002	0.35	0 8164
48-Ch	17.858	n.f.	161.795
49-Ch	2 4635	n.f.	311.625
50-Ch	0.0203	n.f.	4.98
51-NK	0.0007		14.256
54-O	sulphur	n f.	sulphur
	NIZHNI NOVGOROD PROVINCE		
14-D	0.093	14 075	n.f
15-D	0.0008	n.f.	1.225
17-D	0.0004	0.6542	4.69

TABLE 4.31

MAH and PAHs IN SEDIMENT SAMPLES (μg/kg) (calculated data)

No	Toluene	Naftalene	Fluorene	Fenanthrene	Antracene	Fluoranthene	Pyrene	Benzoperylene
				KUIBYSHEV WATER RESERVOIR				
1-K	d	d	0.8	d	d	d	d	0.5
2-K	d	d	22	d	d	d	d	0.5
3-K	d	d	1.6	d	d	d	d	d
4-K	d	32	d	29	5	d	d	d
5-K	350	66	8	81	-	147	-	15819
6-K	6750	-	-	153	23	-	400	27688
7-K	d	93	d	23	6	22.4	d	d
8-K	d	79	d	28	6	d	d	d
9-K	d	81	9	31	5	d	d	d
10-K	d	d	d	51.4	31	d	d	d
11-K	d	d	53	80	d	16	d	5
				SAMARA PROVINCE				
34-S	390	200	10	270	-	250	-	d
43-S	d	61 4	d	d	18	d	d	5
53-NK	1750	37	30	87	30	1267	120	134
51-O		<80	40	500	150	1200	900	300
				NIZHNI NOVGOROD PROVINCE				
4-N	600	130	-	140	15	-	240	4000
5-N	1790	-	30	500	120	-	5740	15870
6-N	1915	230	30	230	-	12320	-	32400
11-N	-	40	d	60	d	-	80	480
12-N	1280	135	33	170	6	1000	60	2560
15-D	3660	123	-	46	6	47	-	d
17-D	480	71	10	137	-	243	-	643

TABLE 4.32

BENZO(a)PYRENE IN SEDIMENT SAMPLES (μg/kg) (calculated data)

No	B(a)P
NIZHNI NOVGOROD PROVINCE	
8-N	9.0
11-N	10.6
14-D	18.0
15-D	12.0
19-D	10 0
KUIBYSHEV WATER RESERVOIR	
1-K	1.0
2-K	0 6
3-K	0.4
4-K	0.6
7-K	2.8
8-K	2.0
9-K	1.4
10-K	2.2
11-K	6.0

No	B(a)P
SAMARA PROVINCE	
33-S	2.6
34-S	40 0
36-S	3.8
41-42-S	5.2
43-S	5.6
47-Ch	3.0
48-Ch	55.0
49-Ch	62.0
50-Ch	4.4
51-NK	12.6
54-O	3 8