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RECONNAISSANCE REPORT: WATER SUPPLY, WASTEWATER, AND WATER MANAGEMENT ISSUES

Federation of Russia

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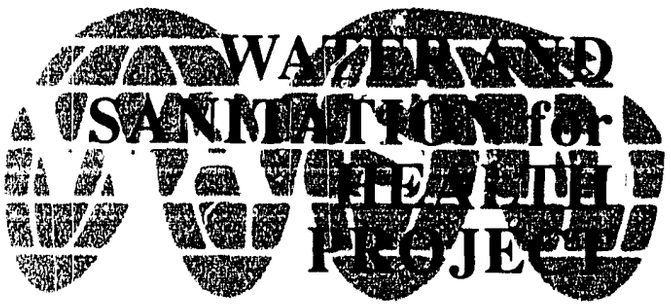

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Prepared for the NIS Task Force and the Office of Health,
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by

Donald E. Cullivan

March 1993

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Related WASH Reports

Point Source Pollution in the Danube River (Summary). WASH Field Report No. 374 by Robert Thomas et al. July 1992.

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ACRONYMS

BOD	biochemical oxygen demand
COD	chemical oxygen demand
EBMUD	East Bay Municipal Utility District
IBRD	International Bank for Reconstruction and Development (World Bank)
lcpd	liters per capita per day
MOE	Ministry of Environmental Protection
NGO	Nongovernmental organization
RBA	River Basin Agencies
SCSES	State Committee for Sanitary and Epidemiological Surveillance
SCWRM	State Committee for Water Resource Management
USAID	United States Agency for International Development
WASH	Water and Sanitation for Health Project
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

Introduction

At the request of USAID, a WASH consultant joined a team assembled by the World Bank, or International Bank for Reconstruction and Development (IBRD), for a broad Environmental Project Identification and Preparation Mission to Russia in October 1992. WASH participated in that portion of the IBRD mission assigned the responsibility for the identification and formulation of a potential IBRD project to improve water quality within a river basin by means of an integrated water resource management project.

The role of the WASH consultant was to support the efforts of IBRD; to be alert to possible related projects for providing U.S. bilateral technical assistance to Russia with emphasis on municipal water and wastewater facilities; and to identify important problems or issues in Russia that affect water and wastewater systems.

In addition to Moscow, the IBRD/WASH team visited the cities of Kemerovo and Novosibirsk in Siberia, and Jaroslavl, 250 kilometers north of Moscow. The team spent three weeks in country, interviewed about 50 water sector officials, and made field inspection visits to two water treatment plants and five wastewater treatment plants.

Early in the trip, IBRD identified a potential project in the Tom River Basin in the Kuzbass area, which surrounds Kemerovo. With French assistance, a consultant has nearly completed a study that will present broad recommendations for water quality management improvements in the Tom River Basin. The WASH consultant then investigated problems in the sector and identified a possible program for USAID technical assistance.

Findings

Serious threats to the health of the Russian people exist because of degraded water quality in general, and contaminated drinking water in particular. Uncontrolled and severe pollution from industrial wastewaters is the principal cause of these threats. Additional contributors to pollution include treated domestic wastewaters; airborne emissions from industry and vehicles; and agricultural, feedlot, and mine drainage runoffs to surface waters.

This waterborne pollution creates a threat to public health in two ways:

- Wastes contribute a heavy load of organics to the rivers used to supply water treatment plants. All water treatment plants use chlorine for disinfection. This combination leads to the formation of chlorinated hydrocarbons in the drinking water supply, which poses risks of cancer to those who drink the water.

Russian officials generally are aware of the problem but are unable to solve it at the levels at which they operate. The problem does not appear to have the attention of top decision makers.

- The second problem relates to the discharge of heavy metals and other toxic wastes from industries. These discharges end up in municipal wastewater treatment sludge, and in surface and groundwaters. This situation has two consequences. The contamination of the sludge makes it unsuitable for spreading on soil as a fertilizer as was done before, so huge stocks are building up at wastewater treatment plants. Examples of just two cities show buildups at a rate of 15,000 m^3 per day at one plant in Moscow and 500 tons per day at Nizhny Novgorod (Gorky). These stockpiles are reaching unsupportable levels.

  The other consequence is that leachate from these stockpiles is contaminating groundwaters and streams, and additional amounts of heavy metals, phenols, and oils are reaching these waters either directly from the industries or from residual amounts from wastewater effluents that are not collected in the sludge.

Visits to water and wastewater facilities indicate that construction practices are very poor in most places and that the metals and materials used are selected to minimize first cost with little regard for life-cycle costs. Maintenance is neglected and facility appearance is poor. Despite these problems, the plants appear to be functioning reasonably well.

Another serious problem is the lack of enforcement of laws and regulations, overlapping and competing governmental agency responsibilities in the sector, and a general lack of direction or good management of the water resources sector. Municipalities are nominally responsible for their water and wastewater facilities but lack the autonomy to operate these services effectively.

Most of the Russian officials contacted appeared to be competent and knowledgeable, but they are overwhelmed by the lack of funding and guidance toward solving their problems.

Water losses and waste are high, but user charges for water are extremely low. The entire water and wastewater sector has been and continues to be heavily subsidized by the central government. The government's economic difficulties have resulted in the nearly complete stoppage of construction work in the sector and have contributed to the degradation of the quality of services over the past few years.

Recommendations

General Recommendations for a USAID Program

Senior Russian water sector officials cited many other areas of concern relative to this sector, including individual cities and entire river basins. It is suggested that USAID pursue a program

that stresses a broad approach to these problems rather than focusing on individual cities or utilities.

The magnitude of the problems in the greater Moscow area, the fact that Moscow and the Volga River were frequently mentioned as water sector problem areas, the availability of extensive local expertise and laboratory facilities, and Moscow's importance and prominence as Russia's capital suggest that this region be considered for USAID assistance. The Moscow-Oka River Basin is one of six legally designated subdivisions of the Volga River Basin, and it is proposed that USAID focus its activities within this river basin.

Objectives of a USAID Program

The principal objectives of the recommended USAID program are to address the concerns described in this report in a manner that makes full use of available knowledge and experience with similar problems in other countries, through the provision of a limited number of expatriate specialists and experts to work with Russian counterparts.

A draft scope of work for the recommended program is included in Annex C. This program includes the following specific objectives:

- *The Mitigation of the Adverse Consequences of Existing Industrial Wastes*

  Purpose: Industrial wastes are considered to be the principal cause of the degradation of Russian waters and the threat to the health of those who drink treated water taken from these waters. A long-term solution of improving drinking water quality depends on the solution of industrial waste problems.

  End Product: A series of recommendations for a long-term program for the mitigation, reduction, or elimination of the adverse consequences of existing industrial wastes in the Moscow-Oka River Basin.

- *The Removal of the Risk to the Public Health of Drinking Water That Contains Chlorinated Hydrocarbons*

  Purpose: The existence of chlorinated hydrocarbons in drinking waters is widespread and constitutes a risk to the health of those who drink this water. Resolution of this problem should be a priority.

  End Product: A program of alternatives that present ranges of cost, effectiveness, and length of implementation time to achieve this objective.

- *The Removal of the Stockpiles of Contaminated Sludge from Existing Wastewater Treatment Plants*

  Purpose: Russia cannot sustain the present practice of storing contaminated sludge at the treatment sites. Existing storage practices often allow contaminated leachate to carry heavy metals and other toxics to the nearby rivers and groundwaters.

End Product: Recommendations on feasible and economical technologies for the safe disposal of the sludge. The selected project would serve as a pilot program for expanded efforts elsewhere.

- *An Understanding of the Relative Contributions of Other Sources of Pollution in Addition to Industrial Wastes*

  Purpose: Data must be obtained to compare the contributions to pollution from other sources with those from industrial wastes. These data will verify the magnitude of the threat to public health of the inadequate treatment and disposal of industrial wastes. Thus government and the public will mobilize to take action to mitigate this threat.

  End Product: A summary, for the Moscow-Oka River Basin, of the relative amounts of pollutants being contributed to water sources in that basin from industry, residential, and other significant sources.

- *The Provision of Broad Recommendations for Improved Management of Water Resources and Water Quality in the Entire River Basin*

  Purpose: The interrelationships of the protection of water bodies, water treatment, and wastewater treatment are such that they can only be logically approached on a river basin basis.

  End Product: A staged plan for the development of an autonomous capability within the Moscow-Oka Water Basin Agency to manage effectively its water resources and regulate the extraction of its waters and the treatment of wastes generated by all entities within the basin. This plan should consider making recommendations to provide the municipal water and wastewater utilities with the autonomy and power to operate their facilities.

This is a very complex and ambitious program. The Moscow-Oka River Basin, though only a subsection of the Volga, is a very large area and may be too large for the type of pilot program envisaged here. On the other hand, Russia's problems are so massive that this complexity will have to be faced at some point. Accordingly, this area may be representative of the magnitude of these problems and, therefore, a realistic one in which to start.

The basic purpose of this program is to suggest possible avenues of solutions to the identified problems, to work with Russian specialists to assist them in it may be approaching these problems, and to gain an understanding of the magnitude of the resources needed to resolve these problems. The program anticipates a very extensive use of Russian specialists and laboratory facilities, and a minimum of very experienced U.S. or Western specialists in the fields required to address these problems.

If the proposed program is beyond USAID's present budgetary allowances, consideration might be given to exploring with other countries the possibility of their joining with USAID to provide additional bilateral assistance for the program.

Implementation

Implementation of the proposed program includes these suggested steps:

- Discussion and general agreement among officials of USAID/Washington and USAID/Moscow concerning the proposed program.
- Estimation of the resources needed to implement the program, including both USAID and Russian contributions. This may include a follow-up visit to verify the magnitude of the effort required, and possibly to modify the program as determined by USAID's internal discussions.
- Discussion of the agreed program with senior Russian officials at the prime ministerial level to determine potential interest in the program, and to obtain their agreement in principal to contribute the local resources proposed for the implementation of the program.
- Discussion, as appropriate, with other potential bilateral donors about their interest in participating in this program.
- Preparation of a detailed terms of reference for the selection of consulting services and a revised estimate of costs and resources required to implement the program.

Chapter 1

OBJECTIVES AND METHODOLOGY

1.1 Introduction

The World Bank, or International Bank for Reconstruction and Development (IBRD), planned and executed a broad Environmental Project Identification and Preparation Mission to Russia during October 1992. The IBRD officer in overall charge of this project was Mr. Roger Batstone, Principal Environmental Engineer for Infrastructure, Energy, and Environment Operations.

One component of the mission included the identification and formulation of a potential IBRD project in an appropriate river basin to improve water quality as part of an integrated water resources management plan. The project also was expected to include improvements to water supply and wastewaster systems in selected municipalities within the river basin. The IBRD officer responsible for this component of the mission was Mr. Alain Locussol, Senior Sanitary Engineer for the Infrastructure Division, Technical Department (EMTIN).

1.2 Objectives

Role for USAID

The United States Agency for International Development (USAID) offered to support the IBRD in this water sector component by providing a specialist through the Water and Sanitation for Health (WASH) Project. IBRD agreed, and the services of Mr. Donald Cullivan, an environmental engineer who has provided technical consulting services to both WASH and IBRD in the past on water and wastewater sector issues, were made available to the mission.

Mr. Cullivan's scope of work was derived from terms of reference prepared by the IBRD's Mr. Batstone, a cable from USAID/Washington to USAID/Moscow, and a scope of work prepared by WASH. Annex A summarizes the various scopes of work.

Role for WASH Consultant

In summary, the role of the WASH consultant was to support the efforts of the IBRD, to be alert to possible related projects for providing U.S. bilateral technical assistance to Russia with emphasis on municipal water and wastewater facilities, and to identify important problems or issues in Russia that affect water and wastewater systems. The fourth requirement was to report these findings to the Government of Russia, IBRD, USAID/Moscow, and USAID/Washington.

1.3 Methodology for IBRD Project Selection and Role for USAID

Preliminary Meetings

Mr. Locussol arrived in Moscow on October 6 and, with the assistance of an experienced technical interpreter, Dr. Vladimir Tsirkunov, conducted a series of meetings with various Russian Federation officials from October 7-9. For details, see Annex B for a list of persons contacted. Mr. Cullivan arrived on October 9 and participated in a further series of meetings in Moscow through October 13.

Preliminary Selection of Kuzbass Region

The results of those early meetings led the mission to believe that the Tom' River Basin in the Kuzbass (Kuznetz Basin) area of Western Siberia met the criteria established by IBRD for a candidate project. These criteria are as follows:

- The existence of poor public health resulting from degraded environmental conditions;
- Expressed willingness of local authorities to take actions to resolve local problems; and
- Readiness of a project (for IBRD appraisal) in terms of studies under way for recommendations for improvements.

Kuzbass Region Selected by IBRD

The Kuzbass Region and the Tom' River were mentioned by several groups as areas of significant environmental distress. Bilateral assistance from the Government of France has funded studies by the Seine-Normandie Water Agency, which are expected to result in a feasibility study for improvements. A field trip to these areas confirmed the strength of the interest of local officials to support such a program, as well as evidence of the existence of the other factors listed in the criteria. The mission visited Kemerovo, the capital city of Kemerovo Oblast (Region) from October 14-17, 1992. Kemerovo is in the heart of the Kuzbass Region. Some 3,000 km and four time zones east of Moscow, Kemerovo is in Western Siberia.

Prior Commitments Preclude Role for USAID in Kuzbass

Assuming acceptance by the Russian Federation of an offer of IBRD assistance to finance a project in the Tom' River Basin, the existence of bilateral support from the French appears to preclude any role for similar assistance from USAID relative to this project. The WASH consultant fully concurs with the IBRD mission that the Tom' River Basin appears to meet all the criteria for a very useful pilot project for approaching water quality problems on a river basin basis.

Focus of Activities for WASH Consultant

Accordingly, the balance of the WASH consultant's time was spent in looking at alternative approaches for the best use of USAID technical assistance directed to the basic problems of municipal water and wastewater utilities. Field visits, talks with officials, and a review of past appraisals make it clear that the factors affecting these utilities are to a large extent beyond their control.

Need for Broad Approach to Water and Wastewater Improvements

Direct assistance for the improvement of water and wastewater systems will be of limited value until some of the more serious problems affecting water quality in Russia are addressed, together with such institutional issues as moving toward financial self-sufficiency, control of water waste and losses, and clearer lines of responsibility within the sector.

Chapter 2

WATER QUALITY ISSUES IN RUSSIA

2.1 Water Quality Problems in Surface Waters

Factors Affecting Water Quality

Most regions of Russia have an abundance of water supplies in the form of rivers, lakes, reservoirs, and underground supplies. Past practices of centrally controlled development have placed these resources at risk by adopting policies of increasing industrial production with little thought or attention to the environmental consequences of these policies. Some of these and other factors that adversely affect water quality throughout Russia are described in the following sections.

Industrial Pollution

In 1989, industry accounted for 55 percent of the gross domestic product in Russia,[1] which is very high, even in comparison with newly industrialized nations such as Korea (45 percent). Very few industries are said to provide pretreatment of their wastes prior to discharge to the sewerage system.[2] Industrial wastewater constitutes 40 percent of total wastewater flows in Moscow. The amounts were 30 percent at the Kemerovo wastewater treatment plant (WWTP), 25 percent at the Novosibirsk WWTP, and 50 percent at the Jaroslavl WWTP, the three other plants the mission visited. While there is some disagreement about the adequacy of existing laws to control industrial pollution, there is little doubt about the lack of adequate enforcement of such regulations as may exist. (See section 3.2 for a discussion of the fee system related to the discharge of industrial wastes.)

Recognizing the importance of industrial wastes to their water and wastewater operations, the Moscow water and wastewater officials are said to have conducted a detailed inventory of the type, location, flows, and strengths of industrial wastes generated in their area of service as a prelude to a planned program to control or mitigate the effects of these wastes. No apparent progress has been made since these studies were completed several years ago.

Much of the technology of Russia's industry, particularly that dating back to the 1940s and 1950s, is said to be inefficient and particularly uncaring of environmental consequences, both

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[1] The World Bank, "Russian Economic Reform," September 1992. See Chapter 10, "Environmental Issues and the Transition to a Market Economy" for additional information of interest relative to current problems in the water resources sector.

[2] Mr. Fedor Daineko, Chief Engineer of Moscow's largest WWTP, said there is little pretreatment of industrial wastewaters discharged to the public sewers in Moscow, and that these wastes cause significant operational problems for the plant. Discussions on October 23, 1992.

in terms of water and air pollution. Little information was provided in response to requests for information about any attempts to evaluate the feasibility of making process changes, which might reduce waste products from existing processes, or even to make industries more efficient by reuse or other techniques to reduce the amounts of costly process materials, which now end up in waste streams.

The World Bank report cited above emphasizes that much of the existing industrial technology will be replaced as Russia moves to a market economy. This process will result in the closure of excess or redundant capacity and the gradual introduction of more efficient industrial technologies to replace much of the obsolete works now contributing heavily to pollution.

During a mission field visit, a local official charged an industry manager with the diversion of raw wastes directly to the river for a period of time in the recent past. Data for such occurrences are impossible to obtain, but the current climate of economic and political uncertainty makes it likely that this is not a rare event.

The widespread lack of or inadequate pretreatment of industrial wastes, the magnitude of inefficient industrial processes, the huge numbers of industries in and around urban centers, and the risk of direct discharges to rivers and streams of huge volumes of industrial wastes are probably the greatest contributors to the degradation of surface waters (and an estimated one-third of the groundwater resources) in Russia.

Agriculture and Livestock

The Mission collected no data on the magnitude of the polluting effect from these elements on the economy, but anecdotally it appears to be severe. There are few controls over these activities, which may account for a significant amount of non-point pollution. Russian agriculture is said to practice the "more-is-better" theory when it comes to the application of pesticides and fertilizers. Agriculture is also said to be a significant and inefficient water user.

Mine Drainage

Some areas, such as the Kuzbass Region visited by the mission, are major sources of anthracite coal. The mission did not investigate the problem in any depth, but drainage, pumping from active mines, and overflows and seepage from abandoned mines are said to be significant polluters of water in their areas.

Non-Point Pollution from the Air

In addition to the sources described above, one of the most serious sources of non-point pollution results from the fallout of airborne pollution, either by gravity in fair weather or as carried to earth by snow or rain. This occurs over large areas near industrial and powerplant stacks and includes the burning of waste gases or auto and truck emissions.

Motor vehicles are said to contribute about one-third of the total hazardous emissions in urban and industrial areas, even though the use of unleaded gas is said to have increased to nearly

half the total production in the past 10 years.[3] The World Bank report also states that SO_2 concentrations in many areas are above 300 ug/m^3, twice the United Nations' safety threshold.

The lack of industrial pretreatment of liquid and solid industrial wastes extends to gaseous emissions, where the use of effective stack scrubbers or electrolytic precipitators is limited. IBRD specialists are looking at these problems in more detail. The problems are mentioned here because they are believed to be significant contributors to the degradation of water quality in surface water in urban centers from which the cities obtain much of their drinking water.

Residential Wastewater

About 90 percent of cities with populations over 10,000 are said to have wastewater collection and treatment systems.[4] Field visits by thismMission and other visitors to treatment plants in some eight large cities, while noting problems of various types, generally provided evidence of relatively effective removals of BOD and suspended solids. These are the two main pollutant parameters frequently used to measure treatment process efficiency for plants treating mostly residential wastewater. Accordingly, the residential component of municipal wastewater treatment plant effluents probably is not a significant component of the range of pollutants contributing to the degraded condition of surface water.

Surface Water Quality Measurements

Considerable data on the specifics of surface water quality at intakes to water treatment plants are available, but only limited information was collected by the mission. A paper prepared about 1990, "Main Perspectives of Efficient Water Use in the City of Moscow," reports that "water quality in the water supply sources is deteriorating," and concludes that this "is a great problem." Almost all other officials also referred to "increasing" problems in the degradation of surface water over the past several years.

From the "World Laboratory" in Kemerovo, the mission obtained two diskettes that provide water quality data for the Tom' River. One relates to the "ecology of the waters of the Tom' River Basin," and the other is said to provide specific water quality measurements at various locations on the Tom' River from 1987 to 1991. The reports are in Russian.

The mission also collected tables showing seasonal analyses for a wide range of parameters in two rivers at Jaroslavl. Analyses of the Volga River showed consistent coliform bacteria levels, for all four seasons, at over 25,000/100 ml and as much as 120,000/100 ml in 1991. BOD levels were about 2 mg per liter and COD levels were over 30 mg per liter. These are extraordinarily high levels given the magnitude of the flow of the Volga River and are

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[3] The World Bank, "Russian Economic Reform," September 1992.

[4] Ware, Peter. Water Supply and Sewerage Section, "Urban Services Exploratory Mission to Russia," IBRD, March 1992.

indicators of very high levels of pollution. Water quality in the Volga at Jaroslavl was deemed sufficiently poor that officials at the Oblast (Regional) level instructed local authorities to shut down the Central water treatment plant a few years ago.[5] When advised of the magnitude of the effects this closure would have on the people because of the resulting water shortages, the ban was revoked.

There is little doubt that the raw waters used by most urban water treatment plants are unsatisfactory in many ways, and specific details can be obtained to substantiate that fact.

2.2 Performance of Water and Wastewater Treatment Plants

Prior Assessments

The most comprehensive, recent assessment of water and wastewater treatment plants was a study made of facilities in four large cities: Nizhny Novgorod (formerly Gorky), Ekaterinburg (formerly Sverdlovsk), Novosibirsk, and Ryazan. In March 1992, a consultant to IBRD conducted this study.[6] Also informative was a letter report[7] on September 1989 visits to water and wastewater treatment plants in Moscow and St. Petersburg (Leningrad at that time) in Russia, and Kaunas and Vilnius in Lithuania (part of the USSR at that time).

Field Visits During this Mission

Reconnaissance visits were made to municipal water and wastewater treatment plants and an industrial wastewater treatment plant in Kemerovo, a wastewater treatment plant in Novosibirsk (the same one reported on in the March 1992 IBRD study), Moscow's largest (3,800,000 m^3 per day) wastewater treatment plant, and water and wastewater treatment plants in Jaroslavl.

Summary Description of Common Problems

While it is risky to generalize about such a large number of facilities, many of the mission's observations, were sufficiently supportive of the findings reported by others as to warrant the following observations, which describe most of the facilities:

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[5] Discussions with water sector officials at Jaroslavl, October 26, 1992.

[6] Ware, op. cit.

[7] Internal correspondence provided to USAID on the findings of the East Bay Municipal Utility District, Oakland, California (EBMUD), as a result of an exchange of visits between EBMUD and the Moscow Water and Wastewater Utility (Mosvodocanal), September 1989.

- The quality of construction ranges from fair, in Moscow, to very poor in most plants, and extremely poor in several. Concrete work is almost uniformly bad, and steelwork and equipment appear to be in imminent need of replacement.

- Water and wastewater plants are hydraulically overloaded in most cases. Some plants have major inadequacies in capacity for secondary treatment, resulting in the discharge of large amounts of wastewaters that receive only primary treatment.

- Most wastewater plants receive very high proportions of industrial wastes, ranging from 25 percent to 50 percent in plants visited by the mission. Much of these industrial wastes are either untreated or inadequately treated before discharge to the sewers. Such high percentages of a wide variety of industrial wastes cause frequent problems to the biological processes.

- Most water treatment plants use rapid sand filtration, some with anthracite coal and sand as dual media. A few use activated carbon. All use chlorine for disinfection. The current economic situation makes it very difficult to obtain chemicals, and some report doing without for extended periods.

- Most wastewater treatment plants use some form of screening,[8] primary sedimentation by circular clarifiers, rectangular activated sludge basins using compressed air, secondary sedimentation (circular), and usually thermophilic sludge digestion followed by discharge on the site. Moscow uses sludge thickening along with vacuum filters and filter presses for further dewatering. The result is the same: storage on site. Chlorination of effluents was discontinued several years ago.

- Maintenance generally appears substandard and the overall appearance of most plants, water and wastewater, is poor inside and out. Conversely, most plant laboratories were very clean and appeared to be performing the required routine analyses in a timely and efficient manner. Labs, however, reported problems with obtaining reagents and obtaining repairs to equipment.

- Despite these problems, most wastewater treatment plants appear to produce reasonably acceptable effluents. The Ministry of Environmental Protection (MOE) has set effluent standards of 3 mg per liter for suspended solids and BOD for all plants. These standards seem unrealistic and unnecessary.[9] Many operators claimed to be achieving effluents in the 6 to 15 mg per liter range but even this appears to be overstated in view of the frequent overloading (in terms of both

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[8] Many plants were designed to grind the screenings and then deposit the macerated screenings back into the treatment flow process. Because of equipment failures, most of the screenings are now removed for landfill disposal.

[9] This MOE standard was mentioned by officials in Moscow and Jaroslavl, both of whom were clearly upset at being assigned this unobtainable target.

organics and hydraulics) and other observable operational and equipment limitations.

- Very few water treatment plants appear to measure routinely the presence of chlorinated hydrocarbons in the water they pump into the system. Officials at the Research Institute of Human Ecology and Environmental Health[10] stated that 90 percent of present water treatment plants fail to meet World Health Organization standards in one or more measures. About 50 percent fail the bacteriological standards and 60 percent fail the "halogenated compound" limits. Parasites are also a frequent problem. They cited cadmium, lead, manganese, barium, and sometimes mercury as heavy metals found in water used as intake for water treatment plants, particularly in the Volga River Basin.

  They believe industrial wastes to be the greatest source of these heavy metals, with much of the lead coming from vehicle emissions. They said water quality and treatment plants have been deteriorating in Russia over the past several years. Growing pollution in the raw water supplies and increasing problems of obtaining coagulant chemicals and chlorine were mentioned as key factors in this deterioration.

2.3 Water Quality and Public Health

Tentative Nature of the Linkage

There are so many variables that it is difficult to make direct connections between drinking water quality and public health. Nevertheless, some officials in Russia offered data and/or opinions that they believe support the conclusion that this linkage exists, and that public health is at serious risk because of degraded environmental conditions such as poor air and water quality.

Kuzbass Region

The World Laboratory[11] cited averages over the past five years in the highly polluted city of Kemerovo (population 500,000) of 207 cases of enteric diseases per 100,000 children under the age of 14. The rate of birth defects per 100,000 live births was 655 in Kemerovo, nearly twice the rate of 378 for all of Russia, and three times the U.S. rate of 219. The infant mortality rate in the region is about 2,000 per 100,000 live births. This rate is about 20 percent higher than that for all of Russia, and about twice the rate for the U.S. and Western

[10] Dr. Yuri Rakhmanin and Prof. Gury Krasovsky, meeting of October 22, 1992.

[11] Dr. Sergej Sergeyev, Deputy Head, Ecological Section, World Laboratory Branch in Kemerovo, meeting on October 16, 1992. Data from official public health agencies as presented in a report prepared in 1992 to support a request that the Kuzbass Region be classified as "ecologically damaged."

Europe. The World Laboratory also provided tables of morbidity and mortality, from several types of cancer, for children under 14 living in 12 cities in the Kuzbass Region, over the period 1977 to 1990.

The World Laboratory attributed these poor health conditions to serious air pollution, especially in the southern part of the region (concentrations of dusts, ashes, phenols, CO_2, NO_2, and benzapirene exceed standards by factors of from 10 to 30 in Novokuznetsk); extensive pollution of surface water (concentrations of halomethanes, amines, and phenols in the water distribution systems exceed standards by two to three times in the northern part of the region, including the cities of Kemerovo and Yurga); and pollution of underground waters as well as a high concentration of toxic elements in locally produced vegetables.

Dr. Sergeyev said an official from USAID (Center for Infectious Diseases) had visited their office in the spring of 1992. Additional information may be available as a result of that visit.

Russia in General

The State Committee for Sanitary and Epidemiological Surveillance[12] has a network of local centers looking at environmentally related health problems. Mrs. Rogovets cited a series of conditions that she believes contribute to health risks: 13 percent of 1991 samples of tap water in more than 1,000 cities exceeded coliform standards; 20 percent failed one or more chemical component limits; and the trends are definitely toward a deterioration of drinking water quality. These matters are of considerable concern to the Ministry of Environmental Protection, with whom the State Committee is in frequent contact relative to water, wastewater, and health problems.

The Chairman of the State Committee for Water Resource Management (SCWRM)[13] said the government has looked for links between public health and water quality and that the links are obvious. He mentioned the sensitivity of this issue under the existing circumstances.

Chlorinated Hydrocarbons in Drinking Waters

Most drinking water supplies in Russia contain significant levels of chlorinated hydrocarbons. Almost all officials expressed an awareness of the risk to public health caused by this situation but most appeared to be resigned to the "impossibility" of solving this problem with existing resources. The World Laboratory[14] provided tables showing the levels of trihalomethanes in the raw water from the Tom' River and the drinking waters of three cities in the Kuzbass

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[12] Mrs. Alexandra Rogovets, Principal Specialist for Water Supply Hygiene, discussions on October 13, 1992.

[13] Mr. Nicoli Mikheev, Chairman, SCWRM, discussions on October 23, 1992.

[14] Dr. Sergej Sergeyev, Deputy Head, Ecological Section, World Laboratory Branch in Kemerovo, meeting on October 16, 1992.

Region during the period 1989 to 1991. Data were provided for both averages and maximums. Unfortunately, the units of measure were not determined.

Levels of Trihalomethanes in Surface and Tap Waters[15]

	Tom' River		Tap Water	
City	Average	Maximum	Average	Maximum
Kemerovo	8.6	74	22.3	98
Novokuznetsk	3.3	23	6.3	14
Yurga	35.5	115	36.5	128

Heavy Metals in Surface Water Supplies

Heavy metals, most believed to come from industrial wastewaters, are removed in municipal wastewater sludge to an extent that caused the government to prohibit the disposal of the sludge on land as fertilizers as was formerly practiced. Significant amounts of heavy metals are believed to be reaching the surface waters, either directly from industries or as leachate from stored, contaminated sludge. The only data available to the mission on heavy metals in surface water came from the Central Laboratory[16] in Jaroslavl, which presented detailed analyses of water quality in the Volga and Kotorosl rivers, which serve as intake sources for Jaroslavl's three water treatment plants. The findings, in mg per liter include the following:

Arsenic	.001-.0025
Lead	.001-.005
Copper	.002-.003
Zinc	.005-.010
Molybdenum	.001-.005
Oil Products	0.2-3.1

[15] The units were not translated.

[16] Mr. Yevgeny Filipov, Chief of Central Laboratory, Jaroslavl Watercanal, discussions on October 27, 1992.

Chapter 3

THE WATER RESOURCES SECTOR

3.1 Organizational Structure of the Water Resources Sector

Overview

It is extremely difficult to obtain a clear understanding of the organizational structure of the water resources sector for several reasons. The "structure" has evolved from a centrally controlled command economy that blurs the interrelationships among the large numbers of organizations set up for various components of the sector. This basic problem is compounded by the frequent changes in the system being made as Russia tries to evolve to a new economic system. Power struggles add another layer to the problem.

Nomenclature/Translations

Names of organizations are another difficulty. Anglicizing the Russian names of organizations can result in two totally different names for the same organization. This can be noted on the reverse "English" side of the business cards of two colleagues from the same agency. The contrast between "General and Communal Hygiene" and "Human Ecology and Environmental Health" is one example. Neither is very descriptive of this institute whose function appears to be to conduct research and gather data on drinking water standards and quality.

Water Resource Sector Organizations

Some of the most powerful organizations affecting the water resources sector are rarely mentioned in discussions about water sector organization. These include the Office of the Prime Minister, the Ministry of Finance, the Ministry of Health, and whatever national agency may still be making decisions on industrial production.

Within the water sector itself, the relationships among the various agencies are not at all clear. Four tables of organization (called structure charts) were provided to the Mission by the Chairman of SCWRM, itself one of the key sector organizations. These tables of organization were said to be a reasonable approximation of existing conditions, but they still leave a lot of questions unanswered. The tables are summarized as follows:

- *Table of Organization No. 1.* Title: "State Committee for Water Resources Management."[17] This chart indicates the key relationships of SCWRM to others in

[17] The translation for this table is given as the "Federal Organization for Management of Water Resources and Water Economy of Russia *(Poscomvod)*." From comparison with the other tables and interpretive clues, however, it appears that this organization is essentially the same as the "State Committee for Water Resources Management (SCWRM)." Since this is

the water resources sector. SCWRM is shown as reporting to the Vice Chairman of the Russian Federation and supervising some 18 (now believed to be 20) River Basin Agencies.[18] The Agencies in turn supervise some 71 Water Resources Regional Administrations,[19] which control some 51,000 (now said to be nearly 60,000) municipal water supply systems.[20]

A somewhat similar chart places the Ministry of Environmental Protection and Natural Resources in a "dotted-line-to-the-side" relationship with SCWRM.

- *Table of Organization No. 2.* Title: "Relationships Between SCWRM and Other Agencies of the Russian Federation". This interesting chart resembles a Louis XIV sunburst, with SCWRM as the sun with about 25 rays linking it to as many organizations. The rays are labeled in a manner that appears to summarize the basic relationship between SCWRM and the linked agency. For example, the agency Roscomzen link states "Use of the Lands of the Water Funds and Water Protection Areas"; and the agency "GCTS" link states "Coordination of Work While Solving the Problems Arising from Accidents and Natural Calamities of Water Bodies."

  One of the most interesting aspects of the chart is a summary of SCWRM's duties and responsibilities: "Provides water for the people and the economy, manages the usage and protection of water resources, exploits reservoirs and dams, develops and implements methods of payment for water usage, avoids adverse effects on water resources, restores water bodies, and prepares international agreements on the use and control of waters bordering on other countries."

- *Table of Organization No. 3.* Title: "Relationships between the River Basin Agencies and 'Local and Federal' Authorities of SCWRM." This is another sunburst table of organization with radial links to 17 agencies. Some of the agencies include: Local Authorities of Rosgidromet (monitors aquatic environment and hydraulic flow measurements), Roscomzen (responsible for water fund lands and watershed protection areas) and similar agencies.

- *Table of Organization No. 4.* This table appears similar to Table 3 on cursory review of the translation available.

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the translation given on the business card of the Chairman of SCWRM, it will be used throughout this report.

[18] The River Basin Agencies are translated in the tables as "Basin Water Economic Complexes."

[19] These Water Resources Regional Administrations appear to be the regional offices of the SCWRM. The term "Region" invariably refers to an "oblast," which is a state-like political subdivision of the Russian Federation.

[20] Translated as "Water Users" in the Tables of Organization.

Comments on Tables of Organization

One important omission from these tables is how the SCWRM relates to the industries. When queried, the Chairman said they were considered to be included in the "water users" category. Another apparent omission is how SCWRM relates to the State Committees for Sanitary and Epidemiological Surveillance and to Housing and Community Services.

Key Water Resource Sector Organizations

The major agencies include the following:

- *The Ministry of Environmental Protection and Natural Resources.*[21] The MOE appears to be the primary standard-setting, enforcement and decision-making body in matters related to water resources. Some officials in the field referred to an "Environmental Protection Committee" that appears to be an enforcement arm of the MOE, but this could not be verified. Some of the staff of MOE met by the Mission represented the Department of Ecological Monitoring and Analysis; the Department of International Cooperation; the Department of Foreign Relations, which may be the same as the foregoing; and the Department of Centralized Inspection.

- *State Committee for Water Resource Management.* SCWRM appears to have some of the most direct responsibilities for the water and wastewater sector. Much of the information gathered in the field and appointments with other water sector officials were obtained with the assistance of the Oblast (Regional) Director of SCWRM. The regional directors appear to have very close ties to the municipal water and wastewater utilities, but the nature of the links was not clear.

- *State Committee for Sanitary and Epidemiological Surveillance (SCSES).* SCSES has national responsibilities for monitoring the health consequences of any activities that affect surface water and drinking water. They have their own laboratories for routine analyses. SCSES is said to be responsible for drinking water quality but not for standards relating to wastewater treatment.[22]

- *Municipal Water and Wastewater Utilities.* Direct responsibility for the operations and maintenance of water and wastewater facilities is assigned to the municipalities. They report to municipal government officials, usually the mayor, but their performance seems to be under the supervision of several other agencies. Larger utilities such as those in St. Petersburg and Moscow appear to have regional (oblast) rather than municipal status. The suffix "-vodocanal" (meaning watercanal) is frequently used to

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[21] This is believed to be the English equivalent of the most recent name change. The previous name is believed to have been the "Ministry of Ecology and Natural Resources."

[22] Discussions with Mrs. Alexandra Rogovets, Principal Specialist, Hygiene of Water Supply, SCSES, from October 13, 1992.

designate these utilities, e.g., Mosvodocanal. Water and wastewater functions appear to be combined in all municipal utilities.

- *State Committee for Housing and Municipal Services.* This may be a key organization in the sector but the Mission had little contact with it during the trip.

Other Water Sector Organizations

Some of the following organizations may play key roles at times or may become increasingly important. At this time, however, these entities do not appear to have quite the importance of those described above. There may be other similar or related organizations that the Mission was not aware of during the visit.

- *River Basin Agencies (RBA).* SCWRM states that there are now 20 such agencies which were created under law. There are six RBAs just for the Volga and its tributaries. The Chairman of SCWRM has said, however, that a lot of work is needed to strengthen the RBAs and that new legislation is being proposed to achieve that goal. The Chairman said these RBAs will be independent bodies, but their directors all will be appointed by the Chairman of SCWRM. The Mission met only one official of one of these agencies as part of a large delegation at the SCWRM Chairman's office and had no opportunity for discussions. Authorities in some cities appeared unaware of the RBAs.

- *Miscellaneous Committees.* A variety of State Committees and Committees[23] have duties and responsibilities related to the sector. The State Committee of Hydrometeorology has branches that maintain laboratories and other services for monitoring surface water quality and collecting and interpreting data. The Committee on Geology and Use of Mineral Resources is one of the principal agencies for studying and reporting on the uses, quality, quantity, and location of groundwater resources in Russia.

- *Institutes of the Academy of Sciences.* Many research, design, and scientific institutes are associated with the Russian Academy of Sciences with interests and responsibilities related to the water resources sector. Officials at these institutes represent a large body of talent in the sector, but the nature of the relationships of these institutes to each other or to governmental water sector agencies was unclear to the Mission. Some appear to be the source of basic designs for sector facilities; others monitor drinking water quality. A professor[24] of the Institute of Water Problems is also the head of the "Rebirth of the Volga" program. Some institutes are said to operate and maintain relatively sophisticated laboratories, but a laboratory at one institute visited by the

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[23] State Committees are just below Ministries in order of importance. Committees are said to be subdivisions of State Committees.

[24] Dr. Evgeni Venitsianov.

Mission was rather basic. Some of these institutes appear to be analogous to nongovernmental organizations (NGOs).

- *World Laboratory.* This NGO has 12 units established in Russia, two of them are dedicated to environmental issues. The headquarters are said to be located in Italy. The unit the Mission visited in Kemerovo has the formal name of "West Siberian Center of Ecological, Medical & Biological Research." They collect and analyze water quality data and health statistics generated by others but say they check this information for accuracy.

- *Interregional Association for Water Quality in Siberia (Siberian Accord).* This group, located in Novosibirsk, represents the water resources interests of some 19 different regions (oblasts) in Siberia, divided into eastern and western zones. They are in the process of establishing a Western Siberia Committee for Environmental Protection. One of their main purposes is to overcome the "go-it-alone" philosophy so prevalent among the regions. They are trying to solve their own problems since not much help appears to be forthcoming from national or external sources. They are forming a "Council of Environmental Improvements" as a means to attract needed funds to correct their problems.

- *Union of Russian Cities.* This group represents the interests of cities with populations in excess of 300,000. There are about 58 members of the Union, which has a permanent secretariat and a full-time executive director. Its president is Mr. Valery Kirpichnikov. While the Mission had no contact with the Union, Mr. Walter Stottmann of IBRD, at the time of the Mission's trip, visited a Union representative in Moscow: Mr. Kemer Norkin, Director General of Moscow Mayor's Office.

  Mr. Norkin indicated that the group is very strong politically and wants to have a firmer control over the members' water and wastewater utilities. The members are looking for "real" help, and hope to set up a working group of Russian and Western advisors to ensure that the help they get is useful. He mentioned that the problems with the central hot water and heating system are one of the municipalities' highest priorities.

  The IBRD and the Union of Russian Cities are jointly sponsoring an "Awareness Seminar on Urban Management," to be held in the outskirts of Moscow at the Bor Center, February 8-12, 1993. "Management of Urban Services: Water Supply and Sewerage" is one of several topics on the agenda. IBRD indicated that USAID would be invited to the seminar.

- *Ministry of Housing.* Before the start of the Mission, the Ministry of Housing was said to be responsible for municipal water supply. This Ministry was downgraded on September 30, 1992, to two Committees: Architecture and Construction; and Housing

and Community Services.[25] The former was said to be responsible for constructing facilities, and the latter for maintaining them. The only contact the Mission had was an early visit by Mr. Locussol to Mr. Nicolai Zhukov, the Deputy Director of the "Ministry of Municipal Services." Mr. Zhukov was knowledgeable and helpful about the municipal water and wastewater sector, but this agency's name never arose during the many meetings with other sector officials throughout the rest of the trip.

Summary of Water Resource Sector Organizational Structure

The foregoing presentation gives some indication of the fragmented and complex nature of the organizational structure of Russia's water resources sector. Hours spent with senior officials and competent technical interpreters failed to clarify what should have been basic relationships among organizations.

The conclusions reached are that the present structure has very significant overlaps and conflicts; it is not well understood by many of those who are part of the system; the system is undergoing change constantly; and the information presented above may only serve to present a blurred picture of the organizational structure of the water sector as it appeared to be in late 1992.

Nevertheless, the basic organizational structure appears to function, very broadly, as follows:

- Basic responsibility for water and wastewater services is vested in the local government.[26] This includes responsibility for preparing budgets, setting and collecting tariffs, developing projects, and operating and maintaining the facilities. (Note: The ability of the local government to carry out these functions is severely compromised by external constraints.)
- The State Committee for Water Resources Management sets technical policies and performance standards, monitors performance, allocates amounts of water extractions by municipalities and industries, licenses discharges of wastewater from industries to receiving waters, and sets criteria for user fees.
- The State Committee for Sanitary and Epidemiological Surveillance also monitors the performance of municipal water and wastewater facilities, and of industrial wastewater discharges.

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[25] Telephone conversation on October 13, 1992, with Mr. Ray Struyk, Urban Institute, under contract to USAID for a housing project in Russia.

[26] In one of the rare examples of privatization observed in the sector, the Kemerovo water utility was said to be operated by a private company under contract to the city. No details were obtained, but the observable results appeared little different from those of other municipal systems visited.

- The River Basin Agencies are shown as a link between the municipal utilities and the SCWRM, but this does not appear to be happening in practice.
- The Ministry of Environmental Protection and Natural Resources sets policies implemented by the SCWRM.
- The Ministry of Health has overall responsibility for the health of the public served by the local water and wastewater utilities.
- The role of the State Committee for Housing and Municipal Services is unclear.

3.2 Institutional Development Issues

Autonomy of Water and Wastewater Utilities

Theoretically the municipal water and wastewater utilities are responsible for their operations but their autonomy is relatively limited. Projects are designed by the various design institutes whose services appear to be arranged by the SCWRM. The relative sameness of designs throughout Russia demonstrates that there is no concept of independent engineering services. The manner in which construction services are provided indicates there is clearly no control over the quality of the workmanship performed. The utilities also appear to have little control over wastes discharged by industries or over charges for services to their customers.

Charges for Water and Wastewater Services

The central government subsidizes all water and wastewater utilities in Russia. Some information on user charges is presented below. No data were collected on the costs of operation and maintenance. Capital costs have always been paid by the national government, and all construction work at sites visited was suspended because of lack of funds.

Industrial Charges

Industries are charged a set of fees for the water they use and the wastewater they discharge. The Mission obtained a copy of a detailed form that every industry is required to complete and submit annually to the SCWRM. The form has one side for water and one side for wastewater requiring the following information:

- Water: The industry is required to give the name and type of the water source (directly from a river, municipal water supply, or wells), and the amount of water it plans to use for the coming year, by month, and the purpose for which it plans to use this water (using a system of codes).
- Wastewater: The industry also must indicate the type of wastes it plans to discharge, including amounts (quantity of flow) as well as strength (BOD, COD, oils, suspended solids, or others); the amount (if any) and type (primary, biological, physical, or

chemical) of pretreatment to be given to these wastewaters; and the name of the receiving waters or sewers into which these wastewaters are to be discharged.

The regional office of the SCWRM, using rates established by the MOE, then calculates the charge to each industry for the amount of water it plans to use and the volume of wastewater it plans to discharge. It is believed that the water rates are different depending upon whether the water is taken from the ground or a nearby river, or from the municipal utility. The latter charges are said to be currently in the range of from 20 to 80 rubles m^3 (US$.05 to $.20/$m^3$ at late October 1992 rates of exchange).

Charges for the discharge of wastewater are more complex. These are said to be based on a combination of the amounts and strengths of the wastewater, with flows said to account for more than half of the charges. No specific data on these charges were obtained. The industry makes a self-assessment of its water needs and wastewater estimates, but these are said to be checked by SCWRM.

Any water used in excess of that which is approved in the permit must be requested from SCWRM. Any wastewater flows, and/or strengths, discharged beyond those approved in the permit will be charged as additional costs to the industry, at rates "much higher" (no orders of magnitude were offered) than the unit costs levied in the original permit.

The present system of industrial wastewater fees was started in early 1991. By law, these fees should be deposited into an environmental fund and used for environmental cleanup purposes. The fund is controlled locally and divided as follows: 10 percent to the central government (Russian Federation), 30 percent to the regional government (oblast), and 60 percent to the local municipality[27] (city or town). In fact, another official said later that there is a great deal of leeway in how these funds are used, and the purposes often bear little relationship to environmental cleanup.

Residential Charges

Recently the central government authorized the municipalities to set user charges for residential water, subject to the limit that they cannot be increased by more than 100 percent (possibly per year, but this is not clear). Current water use charges are absurdly low, usually in the order of kopecks (figures of 30 to 50 kopecks were mentioned for some cities) rather than rubles per cubic meter. Even four rubles/m^3 is only US$0.01/$m^3$. Doubling these rates annually hardly covers the cost of collection of the charges, or pays for operation and maintenance costs. In today's economic climate, there is little political will to bring user charges in line with the costs of production.

[27] Discussions with Mr. Vladislav Balovnev, Vice Chief of the Executive Committee of the Kemerovo Regional Council of People's Deputies, from October 15, 1992.

Water Losses and Waste

The utilities' customers consist of industries, large public housing complexes, governmental buildings, and commercial enterprises. The extent of metering is uncertain, both at the water treatment plants and at the customers' premises. The present low levels of user charges is such that metering serves little purpose. Per capita consumption levels in the order of 300 to 350 liters per capita per day (lpcd) were reported for primarily residential use, and 450 lpcd for residential and industrial.

The City of Moscow is reported to produce a total of 6.2 million m^3 per day of water to meet the demands (60 percent residential and 40 percent industrial) of from nine to ten million people, which amounts to at least 600 lpcd[28]. The 60 percent of flow directed to residential customers would amount to at least 370 lpcd.

In 1987 the City of Jaroslavl--population 630,000 located on the Volga River 250 km north of Moscow--conducted a study of water use. Meters were installed in 25 apartment buildings with an average of 63 apartments per building and a total of 4,880 people, or 195 per building. Water consumption was measured at an average of 242 lpcd and ranged from 184 to 350 lpcd per building.

The study also measured flow in the early morning hours to determine how much of the flow might be related to losses resulting from plumbing defects. The overall average consumption during this period was reported as being only 7 lpcd, indicating losses of only 3 percent. Such a low level raises serious questions because it does not fit the pattern of reports from others or personal observations over a three-week period of the low quality of plumbing fixtures in the country.

Jaroslavl's water system supplies 50 percent of its water to industries and the remainder to residential and other customers. Per capita production for the non-industrial customers amounts to 280 lpcd, which appears to support the study figures in terms of overall per capita use.

Hot water for general use and for heating is produced at central locations in Russian municipalities. No data were obtained on the amounts of water used for these purposes or on the method of payment for this water. The system is said to be very inefficient. In retrospect, the Mission should have pursued this matter to determine how inefficiency relates to water consumption and user charges for municipal water utilities.

Many of the officials interviewed commented that much of the water produced was being lost, wasted, or used inefficiently. These comments were supported by the extremely low charges for water, the lack of allocation of costs to individual users, the poor condition of the internal plumbing systems, and the estimated heavy losses from distribution systems said to be in poor condition. Because Russian apartments have few water-using appliances and only one

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[28] Mr. Fedor Daineko, Chief Engineer, Kuryanovskaya Wastewater Treatment Plant, Mosvodocanal, meeting on October 23, 1992.

bathroom per apartment, usage in the range of 300 to 400 lpcd appears to support the conclusion that water losses and waste are very high.

Control Over Industrial Wastes and Intake Water Quality

These are institutional development as well as technical issues. The demands on municipal water and wastewater utilities are heavily affected by the industries they serve. From 30 to 50 percent of their total water treatment plant capacity is needed to serve industries, yet the utilities have no voice in setting charges for this usage. They are required to accept the wastewaters discharged to their sewers by industries without any voice in requirements for industrial waste pretreatment charges. Finally, the quality of the water they deliver to their customers is adversely affected by the intake water's degraded quality, which is largely related to industrial wastes.

Payment and Motivation of Staff

The relatively low wages paid water sector workers in Russia is a country-wide problem for nearly all other sectors as well. Lack of staff motivation also is a major contributing factor to the poor quality of construction and inadequate maintenance prevalent at most water sector utilities. These problems are the result of much larger problems facing Russia's current leadership, but they must be solved if the water and wastewater sector is to be placed on a sound footing.

Legislation

From discussions with officials met and other members of the IBRD Environmental Mission, Russia appears to have a wide-ranging set of relatively comprehensive laws and regulations covering almost every aspect of environmental protection and water quality controls. For example, Articles 18 and 42 in the 1977 Soviet Constitution provide formal legal protection for the environment and public health.[29] The major defect in existing laws and regulations appears to be insufficient mechanisms for enforcement. Many adverse actions take place constantly while little effort is apparent to control them. Industry and agriculture, two of the most serious polluters, appear to operate with near impunity in terms of how their actions affect the environment.

Several officials referred to major new legislation affecting water supply, which is now under consideration. Mrs. Rogovets of SCSES listed the following as some of the provisions of the "Russian Act for Potable Water Supply":

- expresses the right of all citizens to safe drinking water;
- allocates responsibility for producing water to various agencies;

[29] Center for International Health Information/ISTI, "Russia, USAID Health Profile," April 24, 1992.

- sets measures for the protection of water sources;
- clarifies the organizational structure and assigns responsibilities;
- establishes the rights of owners of public water supplies;
- establishes standards for compliance with the Act.

The fourth provision above may include the strengthening of the RBAs referred to by Chairman Mikheev of SCWRM, which he said was covered by a new draft law before the legislative body. The Chairman said he expected this legislation to pass before the end of the year, "barring any major changes in the government."

Chapter 4

FINDINGS

4.1 Major Issues and Constraints in the Water Sector

Major Issues

The major water sector issues identified during the Mission, all of them interrelated, include the following:

- the widespread contamination of raw water supplies used to supply water treatment plants, from industrial, agricultural, mine drainage (some locations), and non-point source pollution, much of it airborne;
- the threat to the public health from drinking water with chlorinated hydrocarbons, a problem throughout Russia;
- massive discharges of organics, heavy metals and other toxics to the raw water supplies and the municipal wastewater systems from a combination of outmoded technologies in many industries, which leads to excessive production of wastes; and the lack of adequate pretreatment of industrial wastes at the plant sites;
- the overlapping and inefficient organizational structure for the entire water resources sector and the lack of effective control over industrial and agricultural uses of water and discharge of wastes, which contributes to the existence of these problems by diluting responsibilities and controls and hampers a rational approach to their solution;
- the lack of an adequate system of user charges, which contributes to inadequate operation and maintenance and to excessive water losses and waste.

Constraints

The current poor status of the economy and the corresponding lack of financial resources to address these problems in the water supply and wastewater sector are problems being experienced in many sectors in the Russian Federation. A wide range of individuals and agencies relative to responsibilities for the water and wastewater sector have competing interests. The general condition of confusion in the transition to a new form of economy and government and the willingness of the central government to address these issues, compete with other high priority areas of concern.

4.2 Recommended Program for USAID Consideration

Related IBRD Program

The IBRD has proposed a possible project in the Kuzbass Region, using the pending recommendations of the Seine-Normandie Water Agency whose efforts are being funded by the French Government.

The IBRD program takes a broad river basin approach to water and wastewater problems in the Tom' River Basin, an area with three million people and many industries, with degraded environmental conditions and serious health problems. That a study with recommendations for actions is imminent makes this a desirable choice for the IBRD, which is looking for a bankable project in the near future.

General Recommendations for a USAID Program

Senior Russian water sector officials cited many other areas of concern relative to this sector, including individual cities and entire river basins. As noted in section 1.3, however, it is suggested that USAID pursue a program that stresses a broad approach to these problems rather than a focus on individual cities or utilities.

The magnitude of the problems in the greater Moscow area, the fact that Moscow and the Volga River were frequently mentioned as water sector problem areas, the availability of extensive local expertise and laboratory facilities, and Moscow's importance and prominence as Russia's capital suggest that this region be considered for USAID assistance. The Moscow-Oka River Basin is one of six legally designated subdivisions of the Volga River Basin, one of the largest rivers of the world, some 3,600 km long. The Oka River alone is over 1,100 km long and discharges into the Volga at Nizhny Novgorod (formerly Gorky).

Objectives of a USAID Program

- The principal objectives of the recommended USAID program are to address the concerns described in this report in a manner that makes full use of available knowledge and experience with similar problems in other countries, through the provision of a limited number of expatriate specialists and experts to work with Russian counterparts.
- The specific objectives include the following:
  - *The Mitigation of the Adverse Consequences of Existing Industrial Wastes* Purpose: Industrial wastes are considered to be the principal cause of the degradation of Russian waters and the threat to the health of those who drink treated water taken from these waters. A long-term solution of improving drinking water quality is dependent upon the solution of the industrial waste problems.

End Product: A series of recommendations for a long-term program for the mitigation, reduction, or elimination of the adverse consequences of existing industrial wastes in the Moscow-Oka River Basin.

Method: Study the industries and the wastes they produce to determine the most feasible means of reducing their wastes. Consider whether these industries might be closed down or replaced with more efficient technologies. This area can serve as a pilot program for expansion to other river basins or regions by Russian specialists who participate in this program.

- *The Removal of the Risk to the Public Health of Drinking Water that Contains Chlorinated Hydrocarbons*

  Purpose: The existence of chlorinated hydrocarbons in drinking water is widespread and constitutes a health risk to those who drink this water. The resolution of this problem should be a priority.

  End Product: A program of alternatives which identifies costs ranges, effectiveness, and lengths of implementation time to achieve this objective.

  Method: Alternatives could range from the provision of alternative safe supplies (bottled water or good-quality groundwater in place of surface supplies) to the eventual replacement of chlorination as a means of disinfection, and, ultimately, to the reduction of organics in the raw water supplies to safe levels. Improved pre-treatment technologies also should be considered. Specific studies are proposed for the western and northern water treatment plants at Moscow, each with a capacity of about 1,500,000 m^3 per day. The western plant takes water from the Moscow/Klyazma River, and the northern plant from the Volga River, whose waters are carried by channels to Moscow.

- *The Removal of the Stockpiles of Contaminated Sludge from Existing Wastewater Treatment Plants*

  Purpose: Russia cannot sustain the present practice of storing contaminated sludge at the treatment sites. Existing storage practices often allow contaminated leachate to carry heavy metals and other toxics to the nearby rivers and groundwater.

  End Product: Recommendations on feasible and economical technologies for the safe disposal of the contaminated sludge. The selected project would serve as a pilot program for expanded efforts elsewhere as appropriate.

  Method: Determine the extent of the problem of contaminated (heavy metals) sludge at the Kuryanovo (Moscow) wastewater treatment plant (capacity: 3,800,000 m^3/day), which is presently said to be stockpiling sludge at the rate of about 15,000 m^3 per day.

- *An Understanding of the Relative Contributions of Other Sources of Pollution in Addition to Industrial Wastes*

  Purpose: Data must be obtained to compare the contributions to pollution from other sources to those from industrial wastes. These data will verify the magnitude of the threat to public health of the inadequate treatment and disposal of industrial wastes. Thus the government and the public will mobilize to take action to mitigate this threat.

  End Product: A summary, for the Moscow-Oka River Basin, of the relative amounts of pollutants being contributed to water sources in that basin from industry, residential, and other significant sources.

  Method: Determine the amounts of pollution being contributed by the residential component of municipal wastewater and estimate the range of possible pollutants from all other non-industrial liquid waste sources. Use the industrial waste inventory described in the first USAID objective above to make a comparison of the relative contributions of all sources to pollution of the rivers in this river basin.

- *The Provision of Broad Recommendations for Improved Management of Water Resources and Water Quality in the Entire River Basin*

  Purpose: The interrelationships of the protection of water bodies, water treatment, and wastewater treatment are such that they can only be logically approached on a river basin basis.

  End Product: A staged plan for the development of an autonomous capability within the Moscow-Oka Water Basin Agency to effectively manage its water resources and regulate the extraction of its waters and the treatment of wastes generated by all entities within the basin. This plan should consider making recommendations to provide the municipal water and wastewater utilities with the autonomy and power to operate their facilities.

  Method: Study existing laws and regulations and the responsibilities and powers of governmental agencies within the river basin that relate to water resources and water quality. Consider alternative methods of improving responsibilities for setting standards; monitoring performance; establishing permit charges and fines for non-compliance with standards; assigning basic responsibility and powers to the municipalities for water supply and wastewater services, including their operation, maintenance, and the levying of user charges sufficient to recover costs; and such other matters as may contribute to sound water resource management. The study should incorporate lessons learned from the WASH studies of the Danube River.

Comments on the Recommended Program

This is a very complex and ambitious program. The Moscow-Oka River Basin, though only a subsection of the Volga, is a very large area and may be too large for the type of pilot program envisaged here. On the other hand, Russia's problems are so massive that this complexity will have to be faced at some point. Accordingly, this area may be representative of the magnitude of these problems and therefore a realistic one in which to start.

The basic purpose of this program is to identify possible avenues of solutions to the identified problems, to work with Russian specialists in assisting them in approaches to these problems, and to gain an understanding of the magnitude of the resources needed to resolve these problems. The program anticipates a very extensive use of Russian specialists and laboratory facilities, and a minimum of very experienced U.S. or Western specialists in the fields required to address these problems.

If the proposed program is beyond USAID's present budgetary allowances, consideration might be given to exploring with other countries the possibility of their joining with USAID to provide additional bilateral assistance for the program.

A draft of a possible scope of work for this program is attached as Annex C.

The suggested next steps include the following:

- Discussion and general agreement among officials of USAID/Washington and USAID/Moscow concerning the proposed program.
- Estimation of the resources required to implement the program, including both USAID and Russian contributions. This may require a follow-up visit to verify the magnitude of the effort required, and possibly to modify the program as determined by USAID's internal discussions
- Discussion of the agreed program with senior Russian officials at the prime ministerial level to determine potential interest in the program and to obtain their agreement in principle to contribute the local resources proposed for the implementation of the program.
- Discussions with other potential bilateral donors about their interest in participating in this program as appropriate.
- Preparation of a detailed terms of reference for the selection of consulting services and a revised estimate of costs and resources required to implement the program.

ANNEX A

SCOPE OF WORK FOR WASH CONSULTANT

WATER AND WASTEWATER UTILITIES IN RUSSIA
WORLD BANK/USAID (WASH)

USAID/Washington Fax to USAID/Moscow Mission (9/30/92)

1. World Bank (IBRD) requested USAID to participate in an assessment of water resources/water supply/wastewater management issues in Russia, as part of a broader IBRD Russian Environmental Program.

2. IBRD has asked USAID to provide Technical Assistance (TA) in the water sector, and USAID considering providing TA in support of IBRD loans

3. USAID requesting WASH to work with Russian Institutions to develop an analytical framework for:

   - o Priority Setting,
   - o Institutional/Human Resource Development Issues, and
   - o Identification of Projects for IBRD Funding.

4. WASH Consultant D. Cullivan suggested as participant to IBRD water sector mission to Russia.

IBRD TOR (Water Resources Issues) R. Batstone Memo (9/25/96)

1. Identify and formulate preliminary proposals for actions to be carried out to improve water resources management and water quality in one or two selected river basin(s), and

2. Water supply and sewerage schemes and operations in selected municipalities located in this/these basin(s)

3. Mr. Alain Locussol (IBRD) to be responsible for the above, but

   - o Mr. Walter Stottmann (IBRD) will review and assess the policy and institutional framework of municipal water supply and sewerage enterprises to identify issues which may obstruct future sector development, and

   - o Mr. Alfred Watkins (IBRD) will provide advice relative to possible private sector financing of utilities.

4. Depending upon agreements reached with the Government of Russia, Locussol will prepare a list of activities to be carried out for the preparation of water components of the project, together with corresponding budgets.

5. Appropriate IBRD staff will discuss with the League of Russian Cities the range of possible contributions the League may bring to the municipal water/wastewater sector.

6. The end product will be a Back-to-Office report.

WASH Scope of Work for D.Cullivan (10/08/92)

1. This activity to be in support of a proposed IBRD mission to Russia, and to be part of a larger IBRD environmental program.

2. In collaboration with IBRD staff, the objectives of the assignment include:

   - o Reach agreement with IBRD and Russia on the location for an initial assessment of water supply and wastewater treatment issues in a major river basin in Russia
   - o Visit the region that is chosen and identify priority sites for future pre-appraisals and appraisals, with particular emphasis on municipal water and wastewater facilities
   - o Identify other inportant problems or issues in the region which have an impact on water supply and wastewater treatment
   - o Report findings to the Government of Russia, IBRD, USAID/Moscow and USAID/Washington

3. The primary end product will be a reconnaissance report that:

   - o Describes general conditions in the river basin
   - o Identifies specific priority sites for future pre-investment activities in the basin
   - o Raises questions or issues believed to have an important impact on the water and wastewater sector in the river basin

4. Another product will include a brief WASH trip report which will:

   - o Present a general discussion of the activity,
   - o List all contacts made in Russia, and
   - o Be followed by a de-briefing report to USAID and WASH in Washington, DC.

ANNEX B

LIST OF PERSONS CONTACTED

RECONNAISSANCE MISSION TO RUSSIA
ENVIRONMENTAL: WATER & WASTEWATER SECTOR

WASHINGTON, DC:

2 October 1992 (Office of the World Bank)

Dennis Long	USAID, NIS Task Force
David McCauley	USAID, NIS Task Force
Craig Hafner	WASH, Task Leader
Alain Locussol	IBRD, Sr. Sanitary Engr, Infrastructure Div. Tech Dept:Europe/Cen'l Asia/Mid East/No.Africa
Walter Stottmann	IBRD, EMTIN

MOSCOW:

7 October 1992

Anatoli Lvov	Chief, Department of Ecological Monitoring and Analysis, Ministry of Ecology and Natural Resources (MOE)
Victor Shlihunov	Deputy Chief, DEMA/MOE
Evgenii Konygin	Deputy Director, Department of International Cooperation, MOE
Georgi Tsvetkov	Chief of Inspection, Central Specialized Inspection ,MOE
Eugeni Neiman	Deputy Chief of Inspection, CSI/MOE

8 October 1992

Nicoli Mikheev	Vice Chairman, State Committee for Water Resources Managemennt (SCWRM)
Konstantin Zarubin	Assistant to the Chairman, SCWRM
Evgeny Zybin	Head, Foreign Relations Department, SCWRM
Valery Shetsov	Deputy Director, VNII/VODGEO Institute (Wastewater Treatment Equipment and Practices)
Oleg Demidev	Head of Research Work Coordination Department, VNII/VODGEO Institute

9 October 1992

Mr. Nicolai Zhukov	Vice Chairman, State Committee for Housing and Municipal Services (SCHMS)
Mr. Alexi Nesterenko	Chief, Department of Standardization and Certification of Public Services, Gosstandart
Mr. Yevgeny Kotov	Vice Director, Research Institute of Standardization

12 October 1992

Dr. Danilov-Danielyan	Minister, Ministry of Ecology and Natural Resources

13 October 1992

Mrs. Alexandra Rogovets	Water Supply Official, State Committee for Sanitation and Epidemiological Supervision (SCSES)
Mr. Eugeni Beljaev	President, SCSES

KEMEROVO:

14 October 1992

Mrs. Vera Smirnova	Director, SCWRM, Kemerovo Oblast
Mr. Fyodor Grebenev	Deputy Director, SCWRM, Kemerovo Oblast

15 October 1992

Mr. Vladislav Balovnev	Vice Chief, Executive Committee of Kemerovo Regional Council of People's Republics
Operator/Manager	Kemerovo Water and Wastewater Treatment Plants

16 October 1992

Dr. Sergei Sergeyev	Deputy Director, "World Laboratory", West Siberian Center of Ecological, Medical and Biological Research (an NGO)
Mrs. Tamara Blokh	Chief Environmental Inspector, Azot (Nitrogen) Chemical Manufacturing

NOVOSIBIRSK:

17 October 1992

Mr. Grigory Zelensky	Chief Engineer, SCWRM, Upper Ob River Basin Water Management Subdivision
Mr. Vladimir Ivanov	General Director, "Siberian Accord" Interregional Association (for water quality in Siberia)
Ms. Irina Shiplova	Deputy Director, Siberian Accord
Mr. Vasilij Gribanow	Director, Novosibirsk Wastewater Treatment Plant

MOSCOW:

20 October 1992

Mr. Michael Kochetev	Deputy Chief, Department of Hydrogeology and Geoecology, State Committee on Geology and Use of Mineral Resources
Prof. Leonid Yazvin	Deputy Director for Research, Hydro-Geo-Ecological Research & Design Co. (HYDEC)
Dr. Gregori Barenboim	Head, World Laboratory in Russia (ESCO)

21 October 1992

Dr. Evgeni Venitsianov	Professor at Institute of Water Problems, Russian Academy of Science; and Head of the "Rebirth of the Volga" Program

22 October 1992

Prof. Gury Krasovsky	Deputy Director for Scientific Work, Sysin Research Institute of General and Communal Hygiene, Russian Academy of Medical Sciences (RAMS)
Dr. Yuri Rakhmanin	Chief, Laboratory of Drinking Water Supply, Sysin Research Institute of Human Ecology and Environmental Health (RAMS)

23 October 1992

Mr. Nicoli Mikheev	Chairman, State Committee for Water Resources Management

Mr. Alexander Dyatchkov	First Deputy General Director, "Mosvodocanal", Moscow Government, Municipal Utility Association (Moscow Water/Wastewater Systems)
Mr. Valentin Anuchkin	Chief Engineer, Moscow-Oka Water Economic Enterprise (Moscow and Oka River Basin Agency)
Mrs. Ljudmila Isajeva	Supervisor, Technological Division, Mosvodocanal Wastewater Treatment Plants
Mr. Fedor Daineko	Chief Engineer (and Chief Operator), Kuryanova Wastewater Treatment Plant, Mosvodocanal

MOSCOW

25 October 1992

Dr. John Le Sar	Health Officer, USAID/Moscow

JAROSLAVL

26 October 1992

Mr. Michael Turikov	Director, State Committee for Water Resources, Jaroslavl Oblast (Region)
Mr. Vladimir Petrov	Director, Jaroslavl Watercanal (Water and Wastewater Utilities)
Mr. Valery Raskatov	Chief Engineer, Jaroslavl Watercanal
Ms. Vera Vorepanova	Chief Operator, Northern Water Treatment Plant, Jaroslavl Watercanal
Mr. Victor Volonchunas	Mayor, City of Jaroslavl

27 October 1992

Mr. Yevgeny Filipov	Director/Chief Chemist, Central Laboratory, Jaroslavl Watercanal
Mr. Andrei Chizhov	Chief Operator, Jaroslavl Wastewater Treatment Plant, Jaroslavl Watercanal
Mr. Jeffrey Litch	Business Analyst/New Ventures, Cabot Europe (Associated with a lamp black industry in Jaroslavl)

MOSCOW

29 October 1992

Mr. James Norris	Mission Director, USAID/Moscow

MISCELLANEOUS

Dr. Vladimir Tsirkunov	Chief, Laboratory of Scientific Guidance, Hydrochemical Network of Surface water Quality Monitoring, State Committee of Hydrometeorology/Hydrochemical Institute (Interpreter/Translator to Mission Team from 7-23 October 1992)
Mr. Yuri Fligelman	Professional Interpretor/Translator, provided services to D. Cullivan from 25-30 October 1992.

WORLD BANK OFFICIALS, MOSCOW

IBRD Staff

Mr. Roger Batstone	Principal Environmental Engineer
Mr. Alain Locussol	Senior Sanitary Engineer
Mr. Vadim Voronin	Environmental Specialist, resident in Moscow
Mr. Walter Stottmann	Senior Sanitary Engineer
Mr. Piotr Wilczynski	Senior Environmental Economist
Mr. Alan Watkins	Senior Economist

IBRD Consultants

Mr. Thomas Kearney	Energy Consultant (Long Term to IBRD)
Mr. John Rich	Bechtel, Principal Pipeline Engineer

ANNEX C

DRAFT SCOPE OF WORK
ADVISORY SERVICES FOR MOSCOW-OKA RIVER BASIN

RECONNAISSANCE MISSION TO RUSSIA
ENVIRONMENTAL: WATER & WASTEWATER SECTOR

The Consultant shall perform the services described below for each of the Tasks listed:

Task 1: Mitigation of Industrial Wastes

a. Develop a program, to be implemented by Russian counterparts, for the inventory of industrial wastes in the Moskow-Oka drainage area of the Volga River Basin. This inventory shall (1) obtain data on the location, type, and capacity of the industry, and on the flows, strengths or other characteristics of the wastes (liquid, solid and gaseous) generated by that industry; and (2) determine the type, condition and effectiveness of any pretreatment of these wastes.

b. Provide industrial process specialists for the five largest (in terms of impact of industrial wastes) industrial types (examples might include pulp and paper, petrochemical, metal plating, food processing, equipment manufacturing) who will investigate not less than two plants in their area of expertise. Each specialist shall (1) make recommendations on possible process changes to mitigate the wastes they presently produce, and (2) make recommendations on suggested pretreatment of these wastes prior to discharge to the sewers.

c. Develop a program, to be implemented by Russian counterparts, to determine cost estimates for recommended process changes and pre-treatment facilities for those industries actually studied, and develop generalized cost curves for the remainder based on these specific estimates.

d. Recommend a list of industries in the study area, in order of priorities based on current impact and costs of mitigation, proposed for process changes, pretreatment or both.

e. Assist Russian counterparts in determining the current level of "fees" each industry is currently paying for the right to extract water and discharge its wastes to the sewers or rivers, including any fines for the extraction of more water than permitted, and the discharge of "excessive" pollutants above permitted levels.

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f. For the specific industries studied above in Task 1-b, determine the approximate impact of the costs of process changes and pretreatment on the unit cost of the product they manufacture; and compare this with the level of fees/fines now paid.

g. Determine the type and number of local specialists needed to assist in the completion of this task so as to minimize the number of expatriate specialists required.

h. Prepare a report presenting the information gathered, and the findings, conclusions and recommendations of the studies.

Task 2 Disposal of Contaminated Treatment Plant Sludge

a. Evaluate the current technologies available for the treatment and disposal of contaminated sludges, and the economics related to these procedures.

b. Develop a program for Russian counterparts to execute which will estimate the magnitude of the problem of contaminated sludges in Russia in terms of (1) total volumes of sludge now being stored on site for lack of means of alternative disposal, (2) volumes of additional amounts of sludge being produced daily, (3) approximate levels of contaminants in these sludges and (4) the magnitude and types of risks posed to the public health and the environment by this problem, now and in the future.

c. Assist Russian counterparts in determining the existing volume of sludge stored at the Kuryanova (Moscow) wastewater treatment plant, and prepare a program for sampling from selected areas of the stored sludge for laboratory examination to determine the composition of heavy metals or other toxic materials in the sludge.

d. Evaluate and recommened short term measures to prevent leachate from the sludge reaching underlying groundwaters or adjacent surface waters. Such measures should consider relocation of the sludge to other areas on site which have been provided impermeable bottoms and side slopes, dikes to prevent runoff from reaching surface waters, and means of collecting leachate/drainage and returning it to the plant for treatment.

e. Consider alternative sites in Russia for the storage of contaminated sludges, either as temporary storage until economic technologies can be developed for its treatment, or as a means of providing more economical centralized treatment.

f. Present a recommended program for the pilot testing of the most promising alternative technologies for the solution of this problem.

g. Prepare a report presenting the information gathered, and the findings, conclusions and recommendations of the studies, including financial and economic data.

Task 3 Removal of Chlorinated Hydrocarbons from Drinking Water

a. Collect data and conduct testing programs as described in Task 3b for the following:

City	Treatment Plant	Capacity	River Source
Moscow	Western (1964)	1.5×10^6/Day	Moscow/Vazuza
Moscow	Northern (1952)	1.5 "	Volga

b. Prepare a program for and supervise the work of Russian counterparts in the collection of available data for the water treatment plants and rivers above, including:

- Population served, design capacity, production levels, types of processes, including any pretreatment, and form of disinfection used
- Water quality data for the source river at the intake, for the past two years and for the earliest year of record, by seasons if data are available
- Analyses of the treated water from these plants, for the past two years and for the earliest year of record, by seasons
- Pertinent health data for the populations served by these treatment plants, for sufficiently extended periods to indicate possible trends

c. Prepare a program, to be implemented by Russian counterparts, for conducting laboratory tests once a week over a two month period of the source and treated water supplies at each location to determine the range of organic compounds in the source waters and the presence of chlorinated hydrocarbons in the treated water.

d. Supervise the collection by Russian counterparts of all available data from existing records related to the presence of chlorinated hydrocarbons in treated drinking water supplies in Russia so as to determine the extent of this problem. Such data should be coordinated with information on the source waters for those cities with

chlorinated hydrocarbons, with particular reference to whether the source is from ground or surface waters, and to the presence of organics in the source water.

e. Search western literature for articles relative to this subject and provide copies of pertinent articles to the russian counterparts. As part of this Task, prepare a program for Russian counterparts to search their literature for articles relative to this problem and to provide summary translations to English of pertinent articles.

f. Consider a range of alternative actions to remove or reduce the risk to the public health caused by the presence of chlorinated hydrocarbons. These alternatives should take into account (1) the severity of the risk at various locations, (2) the time to implement remedial programs, (3) the capital and operating costs of the proposed programs and (4) other issues and factors which may be pertinent to this problem.

g. Prepare guidelines for a study to be undertaken by appropriate members of Institutes of the Russian Academy of Science and industrial representatives to determine the feasibility of manufacturing ozonation equipment in the country, including research on minimizing the energy requirements of such equipment.

h. Study and recommend techniques for addding or improving pre and post treatment facilities to minimize the formation of chlorinated hydrocarbons, and recommend a pilot program for one or more of the treatment plants in the study to test promising technical modifications. In particular, the experiences in Jaroslavl using ammonia as part of the pretreatment process should be studied.

i. Prepare a report which presents the study findings and recommends a range of alternative solutions for the short, intermediate and long term. Provide guidance for decision making in determining how best to apply which alternative to which particular situation. Present financial and economic details pertinent to the various recommendations.

Task 4 Prepare an Overview of Pollution of Water Bodies

a. The limits of the study area for this Task is the Moscow-Oka drainage area of the Volga River Basin.

b. Develop a program for the Russian counterparts, based on the use of existing records, to determine the estimated contribution to receiving waters of the effluents from

wastewater treatment plants of the non-industrial portions of the total flow from these plants. This inventory should include data on flows, BOD, and such other pollutional characteristics as may be available from the records.

c. Estimate the contributions to receiving waters from people not served by a public wastewater system.

d. Develop a program for Russian counterparts, based on using existing records and conducting interviews with appropriate authorities, to determine the type, location and magnitude of agricultural production or related activities in the area. This study should include estimates of the type, timing, and amounts of fertilizers and pesticides applied to the crops or fields.

e. Recommend a program for the testing, over a one year period, of the possible effects on ground and/or surface waters of the application of these fertilizers and pesticides on selected test cases.

f. Perform similar studies to those indicated in Tasks 4d and 4e for livestock enterprises.

g. Prepare guidelines for Russian counterparts to use in estimating the pollutional loads on ground and surface waters from any other sources in addition to those listed above and the industrial waste loads to be determined under Task 1.

h. Prepare guidelines for the conduct of similar studies in other river basins.

i. Prepare a report which presents the study's findings and conclusions on the estimated total pollutional loads to receiving waters in the study area. The report should also present the guidelines described in Task 4h.

Task 5 Conduct a Comprehensive River Basin Management Study of the Moscow-Oka River Basin

(Later)

ANNEX D

REFERENCES
REPORTS/DATA COLLECTED

WATER AND WASTEWATER UTILITIES IN RUSSIA
WORLD BANK/USAID (WASH)

1. "Russian Economic Reform", A World Bank Country Study, September 1992.

2. "Water Supply and Sewerage" section of Urban Services Exploratory Mission (to Russia), World Bank, March 1992.

3. "Decree No. 66-699 of 14 September 1966", laws governing water basins in France (in English).

4. Two diskettes with reports (in Russian) on water quality and ecology in the Tom River basin, provided by the World Laboratory, Kemerovo.

5. "Russia, USAID Health Profile", Center for International Health Information/ISTI, April 24, 1992.

6. Regulations for the Kemerov Regional Agency for Water Management, SCWRM, in Russian, with rough English translation, 1992.

7. Series of Tables of Organization (about 5) indicating the relationship of the State Committee for Water resource management (SCWRM) with other water sector agencies, in Russian, with rough English translations, provided by the Chairman of SCWRM.

8. "Prevention of Halogen-Alkanes (?) Formation in Drinking Water Using Ammonia Treatment", article in technical journal, in Russian, untranslated, 1986 (?) Note: One of the authors was Mr. Filipov, director of the central laboratory in Jaroslavl.

9. "Main Perspectives of Efficient Water Use in the City of Moscow", V. Volkov and Y. Matveyev, in English, about 1990.

10. "Water is Life", color promotional brochure of Mosvodocanal, in Russian and English, 1989.

11. "State of the Art and Prospects for the Development of Moscow Wastewater System", V.A. Zagorsky, Deputy Director of Mosvodocanal, in Russian with rough English translation, late 1980's.

12. Miscellaneous documents relating to health in Kemerovo Oblast (Region), from the World Laboratory, Kemerovo:

    a. Charts showing average and maximum levels of trihalomethanes in river and tap water in three cities in the Region

    b. Charts showing birth defects in the Region in comparison with those in Russia and other countries.

    c. Tables showing deaths and illnesses caused by cancer, in children under 14, for the entire Kemerovo region and 12 of its cities, 1977-1990.

    d. A list of Population Health Indices in the Kuzbass (Kemerovo) Region for which data are available.

    e. Note: The above are all in Russian but with partial translations into English.

13. Miscellaneous documents related to water, wastewater, industrial water permits and water quality analyses in Jaroslavl Oblast (Region) provided by officials in Jaroslavl:

    a. Results of a 1987 study of water consumption by about 5,000 people in 25 apartment buildings in Jaroslavl.

    b. Standard application form to be completed by all industries (nationwide) in order to obtain a permit for their expected water use and wastewater discharges for the coming year.

    c. Basic data for 1975, 1980, 1990 and 1991 relative to water and wastewater activities in the Jaroslavl Region. Includes water extractions, amounts used by industry, wastewater treated, cost of facilities and other data.

    d. Summary of water allowed to be used by 19 industries in 1992, by name of industry, for the city of Uglich.

    e. Summary of water allowed to be used by all industries in the 24 cities of Jaroslavl Oblast (Region) for 1992.

    f. Bacterial and physical/chemical analyses of the waters of the Volga and Kotorosl Rivers, averaged by season and for the year 1991, for 36 categories of analysis. Analyses also shown for tap water at the Central water treatment plant for the same categories, as well as the drinking water standards or limits set for those categories.

    g. Note: The above are all in Russian but with partial translations into English.

14. Promotional brochure recognizing the 100th anniversary of water service to Jaroslavl, in Russian, 1983.

15. Table 14 from a government publication titled "Water Intake and Usage in the USSR's Major River Basins, in km^3, 1989. Data are presented for about 40 river basins. Reference is made to a Table 15 titled "Discharge of Wastewaters and Other Waters in the USSR's Major River Basins", but that table was not provided. Table is in Russian but a rough English translation is available. This information came from the Mission's interpreter, Vladiimir Tsirkunov.

chlorinated hydrocarbons, with particular reference to whether the source is from ground or surface waters, and to the presence of organics in the source water.

e. Search western literature for articles relative to this subject and provide copies of pertinent articles to the russian counterparts. As part of this Task, prepare a program for Russian counterparts to search their literature for articles relative to this problem and to provide summary translations to English of pertinent articles.

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g. Prepare guidelines for a study to be undertaken by appropriate members of Institutes of the Russian Academy of Science and industrial representatives to determine the feasibility of manufacturing ozonation equipment in the country, including research on minimizing the energy requirements of such equipment.

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i. Prepare a report which presents the study findings and recommends a range of alternative solutions for the short, intermediate and long term. Provide guidance for decision making in determining how best to apply which alternative to which particular situation. Present financial and economic details pertinent to the various recommendations.

Task 4 Prepare an Overview of Pollution of Water Bodies

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b. Develop a program for the Russian counterparts, based on the use of existing records, to determine the estimated contribution to receiving waters of the effluents from

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c. Estimate the contributions to receiving waters from people not served by a public wastewater system.

d. Develop a program for Russian counterparts, based on using existing records and conducting interviews with appropriate authorities, to determine the type, location and magnitude of agricultural production or related activities in the area. This study should include estimates of the type, timing, and amounts of fertilizers and pesticides applied to the crops or fields.

e. Recommend a program for the testing, over a one year period, of the possible effects on ground and/or surface waters of the application of these fertilizers and pesticides on selected test cases.

f. Perform similar studies to those indicated in Tasks 4d and 4e for livestock enterprises.

g. Prepare guidelines for Russian counterparts to use in estimating the pollutional loads on ground and surface waters from any other sources in addition to those listed above and the industrial waste loads to be determined under Task 1.

h. Prepare guidelines for the conduct of similar studies in other river basins.

i. Prepare a report which presents the study's findings and conclusions on the estimated total pollutional loads to receiving waters in the study area. The report should also present the guidelines described in Task 4h.

Task 5 Conduct a Comprehensive River Basin Management Study of the Moscow-Oka River Basin

(Later)