CDIE
Impact Evaluation
United States Agency for International Development

REDUCING URBAN AND INDUSTRIAL POLLUTION IN RUSSIA

A USAID wastewater treatment project improved Moscow's drinking water and its companion watershed development project advanced environmental education in the districts near Moscow. A third project in Volgograd failed to build a viable air quality monitoring program to curb pollution. Sustainability and replicability were undercut by failure to plan for replication from the outset and promotion of state-of-the-art (rather than appropriate) technology. Lack of good baseline data and the inability to distinguish results stemming from the projects from those related to the economic downturn made independent assessment of project effectiveness difficult.

SUMMARY

Russia has extensive natural resources, some of the best trained environmental professionals, and an unmatched productive capacity. It also has some of the world's most pernicious environmental problems—a legacy from the Soviet era. In many of its largest industrial cities, drinking water is substandard and air quality poor. Pollution standards for industrial emissions are set high, but competing federal and regional environmental laws create barriers to curbing industrial air pollution and halting river and stream discharges. Enforcement of environmental regulations is weak, and fines for violations are set unrealistically low. Russia's emerging market economy has benefited the environment indirectly: many of the most polluting industrial enterprises have either drastically cut production or simply gone bankrupt because they were unable to compete without subsidies or new equipment.

In 1993, USAID launched a multiproject environmental program in Russia as part of an international donor "first-wave"

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effort to bolster political and economic support. This *Impact Evaluation* examines three of those projects—wastewater treatment, watershed development, and air quality improvement. The wastewater treatment project sought to improve Moscow's drinking water by upgrading selected upstream municipal wastewater treatment facilities and industrial enterprises. The watershed development project sought to create a watershed management plan for communities in the Moscow River Basin, aiming to curb runoff (mainly animal waste) from commercial agricultural operations. The air quality improvement project focused on improving conditions in industrial Volgograd by developing a model air quality management program. All three projects were implemented by the U.S. Environmental Protection Agency (USEPA).

In November 2000, USAID's Center for Development Information and Evaluation (CDIE) fielded a four-person team to assess project impacts. Through site visits and in-depth interviews over five weeks, the team found strong evidence that the wastewater treatment project had very positive impacts on targeted treatment facilities. The project also strengthened institutions by using a combination of technical assistance, in-country training, equipment transfer, and U.S. professional study tours. In contrast, efforts under the watershed development activities were much less successful—with the sole exception of developing an environmental curriculum for schools. The air quality improvement project did not meet its primary goal of implementing a comprehensive air quality program in Volgograd.

The lessons learned from the evaluation are that USAID and its implementers must 1) assess carefully the potential for upgrading environmental technology in cash-strapped plants, 2) focus more on planning for replicability from the start, 3) use appropriate (not necessarily state-of-the-art) technology, 4) consider the balance between short-term results and long-term sustainability, and 5) collect baseline and other appropriate data if it plans to assess project effectiveness.

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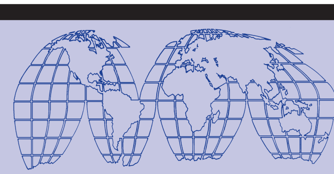
BACKGROUND

Since the breakup of the Soviet Union in 1991, Russia has worked hard to make the difficult transition to open markets and more democratic institutions. The journey toward a complete restructuring of the Russian economy and adoption of wide-ranging political reforms has been perilous. The 1998 ruble devaluation was a severe blow. However, most experts agree that over the past 10 years, Russia, despite many setbacks, has become more open and democratic.

Experts also agree that the environment suffered badly under the Soviet regime. The Soviets gave environmental protection a high priority in principle but a very low priority in practice. Industrial growth was almost always at the expense of clean air, soil quality, potable water, and ecosystem health. Organic, industrial, and toxic spills were frequent, environmental laws were not enforced, pollution fines were set low, and graft and corruption were all too common. The Volga River, Russia's largest, is still severely polluted by industrial waste, sewage, pesticides, and fertilizers. Many Russian cities have air pollution levels that exceed World Health Organization and USEPA limits to protect human health.

Russia's emerging market economy has been a mixed blessing for the environment. Many industrial enterprises are unable to compete in the open market, rely on state subsidies, and use decades-old technologies with few pollution controls. Some enterprises use outdated processes and equipment and are poorly managed or undercapitalized. Many of the worst-polluting factories have gone bankrupt or operate at only 50 to 60 percent capacity. At the same time, democratic reforms have handed regional and local governments the responsibility for cleaning up long-standing urban and industrial pollution. However, reform did not provide authority to enact effective pollution prevention laws and regulations, nor the ability to systematically collect fines from local polluters. And reforms did not furnish the funds needed to help polluting enterprises upgrade (or shut down).

Russia is the largest country in the world—about twice the size of the United States. It comprises 21 semiautonomous republics, 49 regions *(oblasts),* and other territories. Russia's vastness, enormous environmental challenges, unstable regulatory situation, and other factors mean that most USAID assistance is directed at demonstration projects in selected sites rather than at widespread implementation.



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Russia's environmental protection laws can be promulgated by legislative and executive bodies (federal level), by citizens *(oblast* level), and by local governmental bodies (local level). Thus, unlike the United States where state environmental laws (reinforced by federal laws) predominate, Russia often has two or more sets of competing federal and regional laws and regulations. Even worse, these laws are not always consistent. The federal Justice Ministry estimates that 25–35 percent of regional legislation does not conform to Russian federal law.

Environmental laws and regulations in Russia are implemented by a wide array of often-competing government agencies at the federal, *oblast*, and local level. Many of the activities performed at one level of government may also be carried out in parallel at another level, complicating coordination, compliance and enforcement—and implementation of USAID's water and air quality projects, which were focused primarily at the local level.

USAID'S RUSSIA ENVIRONMENTAL PROGRAM: WASTEWATER TREATMENT, WATERSHED DEVELOPMENT, AND AIR QUALITY IMPROVEMENT

In 1992, the Gore-Chernomirdin Agreement provided for the transfer of environmental technology and financial assistance to the Newly Independent States of the former Soviet Union. In response, USAID launched its Russia environmental program.[1] Similar initiatives were mounted in central and eastern Europe. The program was originally designed to bolster political and economic support for Russia and to complement first-wave support from the World Bank and other major donors. It was clear from the program's inception that it was to show tangible results as soon as possible. Funded in 1993 at approximately $35 million, it later reached $128 million. Of the original $35 million, approximately $11 million went to USEPA, $9.5 million went to a U.S.-based consulting firm, and the remaining $15.5 million funded cooperative agreements and other related procurements.

The CDIE evaluation concentrated on two water projects (wastewater treatment and watershed development) near Moscow and an air quality improvement project in Volgograd.[2] USEPA began work on the air quality improvement project in industrial Volgograd officially in September 1993 and began implementing the wastewater treatment and watershed development projects in spring 1994.

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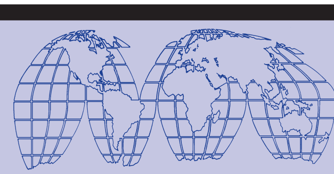
[1]Formally called the Environmental Policy and Technology (EPT) project.

[2]Formally called the Russian Air Management Program (RAMP).

The wastewater treatment project aimed at improving the quality of Moscow's drinking water. The strategy was to introduce new approaches to upgrade the operation of selected wastewater treatment facilities and industrial enterprises upstream from Moscow in the cities of Tver (Tver *oblast),* Gagarin (Smolensk *oblast),* and Dimitrov (Moscow *oblast).* The treatment project sought to improve operations by decreasing pollution loadings using a standard operation maintenance evaluation assessment. This assessment is a systematic review of all the factors (including administrative, maintenance, facility design, operations, and staffing) that limit facility performance. Under this project, Russian specialists also came to the United States to observe assessment procedures firsthand and receive lectures and classroom training. The project also provided a limited amount of used and borrowed equipment. Similar but more modest support was provided to key industrial plants that discharge their waste into wastewater treatment facilities to improve the flow of industrial discharges (so-called pretreatment programs).



The watershed development project sought to reduce (or capture and treat) agricultural runoff into rivers that influenced water supplied to the Moscow oblast. The air quality improvement project sought to improve air quality in Volgograd.

The watershed development project sought to reduce (or capture and treat) agricultural runoff into rivers that influenced water supplied to the Moscow *oblast*. Concentrating on small watershed management practices in the Istra District (located just west of the capital) in the Moscow River basin, this project concentrated on curbing nonpoint-source runoff from farms and from two large agricultural enterprises. The idea was to introduce the latest management approaches at selected demonstration sites, followed by informational open houses and public information campaigns to spread the word to adopt improved agricultural practices. The activities at Istra also included an in-country educational component directed at school children and a teacher exchange program. Both components were designed to increase public awareness, facilitate replication in nearby water basins, support local regulations, and strengthen environmental nongovernmental organizations (NGOs). Other activities at Istra included surveying the environment, polling communities, conducting livestock enterprise feasibility studies, updating an ecological database, reviewing solid waste management procedures, and testing water quality.

The air quality improvement project sought to improve air quality in Volgograd. Volgograd was selected because USEPA ranked it as the sixth most-polluted Russian city and because of prior positive relationships among the World Bank, USEPA, and Volgograd city officials. The project aimed to develop and test a model air quality management (AQM) program, based primarily on training, technology transfer, and public awareness. USAID and USEPA assumed that the model program would later be integrated at the federal level into the Russian environmental regulatory framework and widely replicated.

Nine major components make up a traditional AQM program (see box, p. 5). Air quality monitoring, for example, helps establish the relationship between specific pollution sources and ambient air quality. The air quality project conducted monitoring in the Volgograd "triangle" consisting of the Red October Steel Mill, Volgograd Aluminum, and the Silica Brick Factory. Another component is emissions inventories/emission factors analysis, which is designed to improve performance, increase accuracy, and lower the costs of estimating actual air pollution emission rates. Thus, the air quality improvement project was intended to make the Volgograd emissions inventory more complete and accurate. Other key AQM components include source assessments, emissions testing, human health and risk assessment, and compliance and enforcement

Air Quality Management program elements at a glance…

- Air quality monitoring
- Emissions inventories/emission factors analysis
- Source assessments
- Emissions testing
- Human health and risk assessment
- Compliance and enforcement methods and procedures
- Increasing public participation
- Establishing legal frameworks
- Providing basic training

methods and procedures. This last component included visible emissions (i.e., USEPA Method 9, "readings by trained and biennially certified observers") used in Volgograd to train regulatory staff on alternative inspection methods. The air quality improvement project also had activities in the other traditional AQM components of increasing public participation, establishing legal frameworks, and providing basic training.

PROJECT ELEMENTS

Environmental pollution abatement and management projects typically are built around five elements: economic policy reform, government regulations and standards, institution building, education and awareness, and technological change. Most environmental activities fall into one or more of these elements, and most environmental solutions will involve working with more than one element.

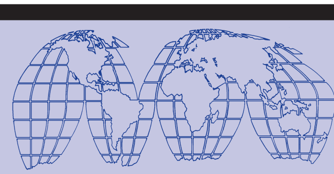
Economic Policy Reform

Economic policy can be an important contributor to sound environmental management. The challenge is to get decisionmaking to reflect the external costs of environmental noncompliance and impacts; proper pricing of resources, appropriate incentives and penalties, and an understanding of financing constraints can help. Although neither the wastewater treatment, watershed development, nor the air quality improvement project was explicitly designed to reform economic policy, an understanding of Russian pricing, incentives, policies, and funding will help interpret performance, impacts, and lessons learned.

Russia has historically undervalued production inputs. Soviet central planning, which did not recognize the role of markets, undervalued production inputs. Subsidizing key inputs, such as oil, coal, gas, or water, can increase the demand for these production inputs and the environmental damage associated with their oversupply and misuse. Artificially low input prices, including the price of energy, lead to excessive consumption per unit of output and high levels of waste and pollution. Even after independence, Russian energy prices were still below market levels, and as a result pollution and natural resource degradation were greater than they would have been otherwise. Russia's inefficiency is clear; in 1997, Russian energy consumption per $1,000 of GDP was 61,000 Btu, the highest rate in the world. By comparison, energy consumption in China was 41,400 Btu per $1,000 of GDP, and in the United States it was 11,600 Btu.

Russia has long had a system of pollution charges, fines, and user fees. Pollution charges on emissions or effluents are defined by law. Fines are five times the pollution charge for excessive emissions or effluents. These market-based instruments, which raised 1.3 trillion rubles ($255 million) in 1996 and 1997, have not proved to be an effective deterrent. The rates are quite low and were not adjusted to reflect the huge ruble devaluation in 1998. Compliance and enforcement are generally weak. Of the 250,000 reported violations, 40 percent continue unpunished or unmitigated. Fees and fines for air and water pollution are collected by the local ecological fund. In theory, 10 percent is transferred to the federal government and 30 percent to the Regional Environmental Committee. Of the 60 percent remaining in the ecological fund, 80 percent (about 43 rubles of each 100 collected) go to wastewater treatment, and 20 percent go for public education and awareness. In practice, a far higher percentage of the amount collected still goes to the federal government, with little typically returned to the local level where payments are collected.

Poor financial performance in most industrial sectors—particularly in older facilities—and the need to protect indigenous industries from lower priced imports preclude aggressive use of fees and penalties at this time. Russia allows water authorities *(vodocanals)* to charge user fees for water treatment services, but these fees are generally insufficient for full cost recovery. Fines and fees are not sufficient to finance needed assistance, nor of sufficient size to serve as a disincentive for illegal, inappropriate, or harmful environmental activities.



Russia has some of the most stringent environmental standards in the world, and some of the laxest enforcement.

Russia lacks adequate financing for environmental upgrades. The restructuring of government environmental institutions, economic downturns, and privatization contribute to this problem, one of the most critical facing Russia. Municipalities are heavily dependent upon federal outlays; most do not have sufficient resources to provide needed services. Municipal bond or lending markets are inadequate, as in many developing countries. A difficult economic and political situation, uncertain intellectual property rights, and changing contract law are not conducive to foreign or domestic investments. Available cash flow is typically used to finance ongoing operations—especially payrolls. The ecological funds exist to provide financing to government environmental agencies, but they depend on unrealistically low fines and fees. Moreover, their capitalization is small relative to the problems, and many of their resources go to salary and operating expenses.

Government Regulation and Standards

Environmental laws, standards, and regulations—and the government's capacity and willingness to enforce them—are the keys to protecting and improving environmental quality. Russia has some of the most stringent environmental standards in the world, and some of the laxest enforcement. Emission standards are national in scope with no allowance for local conditions. This rigid approach often results in standards that are more or less stringent than necessary, and thus provide either more protection and cost than are necessary—or not enough protection.

The complexity of the laws and their inconsistency across jurisdictions reduce effective compliance, drain resources, and undermine the political will for enforcement. The wastewater treatment project designers recognized the importance of introducing more rational environmental laws and regulations, and USEPA established a separate task force to deal with general environmental legal issues. While new measures were largely postponed because of fast-changing Russian politics, the wastewater treatment project successfully introduced the "temporary permit" concept, whereby a plant would be issued a temporary permit and not be fined if it was making progress toward reaching a legal standard. The watershed development project did not address changes in government regulations.

The air quality improvement project sought to strengthen compliance and inspection by addressing air pollution regulations and standards. Russia has some of the strongest emissions standards in the world, but deficiencies in the existing permitting and enforcement processes make successful enforcement impossible. To offset these deficiencies, the project team worked with stakeholders in Volgograd to strengthen the existing system by concentrating on measures with immediate and practical financial benefits. Good examples include the introduction of visual emissions testing (as an enforceable standard) and creative adoption of an oil emulsifying process to dramatically increase fuel efficiency. The air quality improvement project also sought to rationalize the existing emissions fee system and strengthen Volgograd's inspection programs.

Institution Building

Effective management of Russia's environment requires strong institutions that work in close harmony. Strong institutions require political commitment, effective enabling rules and regulations, trained and motivated staff, and sufficient financial resources. Moreover, the environmental conditions facing both users and regulators make it important that institutions adopt a proactive strategy emphasizing collaboration over confrontation. However, the institutions charged with managing the environment are often underfunded and therefore cannot properly staff, train, equip, and manage their tasks. Underfunding for environmental investments typically results from low user charges—and from inadequate federal budget allocations and reallocations. Less than 1 percent of Russia's federal budget is allocated for environmental management and investment.

The wastewater treatment project confronted basic equipment shortages and the lack of familiarity with modern methods in wastewater treatment and facility maintenance and repair. Most of the wastewater treatment facilities lacked even the simplest equipment—basic equipment such as flow meters, automatic samplers, pipettes, dissolved oxygen meters, Sludge Judges, and colorimeters—that would have significantly increased their ability to improve treatment efficiency and effluent quality. Most labs lacked spare parts and reagents for water quality testing. The project provided training for the staff of municipal facilities and industry and a very modest amount of water testing equipment. USEPA cooperators donated additional equipment—but not as a planned intervention.

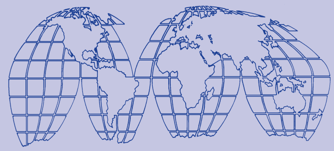
For the watershed development project, the principal problems were 1) a lack of knowledge of appropriate animal waste management techniques; 2) a general public that did not understand animal waste problems or how to address them; and 3) institutions at cross-purposes and lacking sound data collection, measurement, and analytical techniques. In most rural areas, where water pollution loads are predominantly household sewage and agricultural waste, treatment staff had no formal work-related training. They were not able to make even the simplest repairs. According to project papers, USEPA's approach was to "design the Istra project based on the watershed management approach as developed/practiced in the United States." At some sites, project-provided funds were set aside for rural staff so they could make minor repairs and help initiate primary water treatment approaches. The watershed development project at Istra also trained staff in some basic environmental animal waste management methods.

The main air quality improvement project goal was to strengthen environmental institutions, including the Center for Environmental Training, the Volgograd Environmental Services Administration (VESA), and several local NGOs. The project also worked to develop more integration between VESA and the NGOs and to increase NGO collaboration.

Education and Awareness

Public education and awareness can broaden the impact of a technical assistance program by involving more people in support of community-related activities, thus strengthening local government capability. Although not the primary focus of the wastewater treatment project, the watershed development project focused heavily on learning and awareness by educating school children, holding public events, and implementing an extensive grassroots outreach program through newspaper articles and radio campaigns. The most noteworthy achievements were the development of an environment curriculum and associated instructional materials, teacher training, and class activities at seven secondary schools.

The air quality improvement project's education and awareness efforts were directed at increasing public knowledge of environmental matters and air pollution health effects, as well as training regulatory, institutional, and NGO staff on environmental issues. It also built on the proactive efforts of Volgograd environmental officials, city administrators, and citizen advisory groups.



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Technological Change

New technologies and techniques can reduce costs and/or broaden environmental and economic impact. Waste minimization, byproduct recovery, recycling, and pollution prevention are complements to abatement and treatment in improving environmental quality. The wastewater treatment project used operation maintenance evaluation analysis to identify low-cost/no-cost ways to increase environmental quality by improving techniques and performance at existing wastewater treatment facilities. The watershed development project introduced geographic information systems as well as new procedures in animal waste handling, storage, and use.

The air quality improvement project introduced new technology in the form of equipment and training. Training activities focused on operations and maintenance techniques, and technical training in the operation of laboratory apparatus, ambient air and air pollutant source sampling devices, and other equipment. The project also provided visual emissions training, environmental audit support, U.S. air quality familiarization tours, and exposure to the latest environmental management techniques. USAID provided equipment, including $4 million in state-of-the-art analytical laboratory equipment, ambient and source sampling equipment, visual emissions smoke generators (for training and certification), and a prototype steel smelter ceramic cover ("delta") for an electric arc furnace.

IMPACTS

The team assessed the overall project impact along institutional, environmental, human health, and economic dimensions. The team's findings are discussed below.

Institutional Impacts

Institutional impact refers to the establishment and strengthening of environmental institutions.

The team concluded that the wastewater treatment project produced strong and important positive impacts on institutions. Prior to the project, authorities conducted only routine or "grab" water sampling at one point in time. Moreover, locally authorized laboratories were not well-equipped or certified. The team found strong evidence that the project strengthened participating institutions at all levels—regional environmental committees, water authorities, individual treatment facilities, and industrial enterprises.

Most in-country training in wastewater treatment was provided by those who were trained in the United States on project study tours, through local consultants, or through the Smolensk Environmental Training Center—a local project beneficiary. Enforcement institutions (regional environmental committees and laboratories) were provided with tools and training so their "water quality findings" could not be refuted by local industries. Wastewater treatment project training and equipment allowed the labs to become fully certified and to monitor major polluters on a continuous basis. Industry and local government both reported that this monitoring actually reduced conflicts and provided for a more positive working partnership between authorities and industries. Another institution-strengthening accomplishment was the introduction of temporary permits. Russian officials in two of the three *oblasts* visited by the team indicated they had successfully implemented such a permitting scheme after their U.S. study trips, where they had observed temporary permits in action. For example, the Tver *oblast* Regional Environmental Committee now issues about 1,000 permits per year, of which 30 percent are temporary. Seventy-five percent of those issued temporary permits are reaching legal standards within the allotted time. The Russians characterized this innovation as invaluable.

The watershed development project also had a positive, albeit minor, institutional impact by working directly with government institutions and providing training. The team concluded that national, regional, and local government institutions improved qualitatively as a result. For example, the Istra school administration put to good use the training, curriculum development, and teaching materials. The Moscow-based Water Design Institute (*VodNIIinformproekt*) received geographic information system and watershed management training and wove these concepts into its guidebooks, strengthening the collection and analytical capabilities of the many local government institutions involved in data collection. The project also demonstrated the positive benefits of joint efforts in watershed management, in contrast to the Russian practice of separate activities.

At the institutional level, the air quality improvement project provided improved monitoring, compliance, and enforcement tools at the local regulatory agency level and helped develop a better informed and more capable roster of NGOs. It also attempted to influence the regulatory approach at the federal level by introducing new types of air sampling and analysis equipment and procedures, including the introduction of visual emissions as a regulatory compliance assurance tool. Team interviews and onsite meetings with project staff, government officials, and NGO leaders consistently revealed that the air quality improvement project strengthened the capabilities, performance, and effectiveness of VESA, the Center for Environmental Training, and local NGOs, producing marked cooperation among these key players.

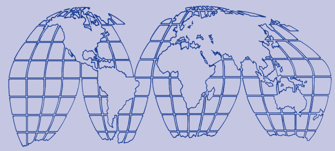
Environmental Impacts

An environmental impact refers to improved water and air quality.

The team found that the wastewater treatment project had a positive impact on the environment. This was the direct result of introducing new equipment and training. Wastewater quality increased at all municipal sites where equipment and training were provided, as documented in USEPA final reports and in onsite data reviews with facility managers. However, estimating exactly how much impact there was proved difficult. There had been no attempt to precisely determine how much improvement was due to the new equipment and how much was due to new methods with existing equipment. Compounding the measurement problem was the general decline in economic activity that altered wastewater composition and treatment volume during the life of the project.

The team found a general consensus among government officials that direct wastewater improvements took place at facilities not directly receiving project assistance through either training or use of new techniques. The Smolensk Environmental Training Center received high praise for training nearly 700 wastewater treatment facility operators during the study period. The Center tracked water quality at many of these "improved sites"—both before and after training—and found decreased loadings at those facilities receiving training. However, the Center did not attempt to separate the improvements in water quality due to the economic situation from improvements due to training.

The watershed development project sought to have an immediate environmental impact through various activities. Project activities included building dams, manure lagoon retaining walls, and storage facilities. Activities also included working with local livestock operations and demonstrating proper manure application. The project successfully implemented much of what it set out to do, but the environmental impact of these interventions was modest. Factors included the relatively small size of some demonstrations, the decline in production activity (mainly agricultural) at others, and the failure of some interventions to take firm hold—such as the planting of seedlings and sludge treatment upgrades. By all accounts, the watershed development project's environmental impacts were negligible.



Despite several published reports that the air quality improvement project reduced air pollutant impacts … by 8 to 12 percent, the evaluation team found that most pollution reductions actually came from curbing nonsmokestack or vent emissions—primarily road dust.

Recent environmental data indicated that Volgograd ranked as the twentieth most polluted Russian city; it was the sixth at the outset of the air quality improvement project. Despite several published reports that the air quality improvement project reduced air pollutant impacts (stationary-source particulate emissions) by 8 to 12 percent, the evaluation team found that most pollution reductions actually came from curbing nonsmokestack or vent emissions—primarily road dust. However, interviews with facility operators and VESA staff indicated that fully implementing the project-recommended measures could have realized approximately an additional 30–35 percent reduction in emissions. Further complicating assessment of the project's environmental impact, major economic downturns dampened the Red October Steel Mill's output and the Silica Brick facility closed (though a smaller, specialty operation continued). VESA officials claimed the environmental improvement in Volgograd was not due to the air quality improvement project but to the general downturn in industrial output and facility closings.

Human Health Impacts

Human heath impacts are those associated with disease prevention and health promotion, reflecting that air pollution contributes to diseases such as lower respiratory infections and chronic bronchitis, as well as respiratory symptom days, hospital admissions, and premature mortality. Similarly, polluted water leads to a range of intestinal and other disorders.

The team concluded that neither the wastewater treatment nor the watershed development project produced measurable human health impacts. In any case, measuring the health impacts of either would have been difficult because the downstream beneficiaries (in Moscow) were not immediate project participants. In theory, improvements in the quality of water provided by the municipal wastewater treatment facilities and industries would be reflected over time in improvements in Moscow's drinking water. However, this assessment was beyond the scope of the wastewater treatment project, and local authorities at the treatment facilities were very hesitant to link changes in their effluents to downstream changes in Moscow's drinking water supply. The team found few, if any, demonstrated health effects from the watershed development project at Istra.

The air quality improvement project also produced no measurable human health impacts, a conclusion confirmed by most VESA interviewees. The project initially sought to prioritize some emission reductions based on the measurement of pollutant exposure in order of severity and the extent of health risk. However, this approach was later abandoned. Plant production downturns, weak assumptions about the links between pollutants and respiratory illness, and the upswing in vehicular nonstationary pollution precluded any assessment of the project's health impact.

Economic Impacts

Economic impacts are all impacts directly valued in the marketplace and incurred directly by project participants (financial impacts) and those borne by additional parties not captured in the financial analysis (e.g., social and health-related costs).

The team could not determine the economic impact of either the wastewater treatment or watershed development projects. First, there was no solid baseline data and second, where baseline data existed, it was not possible to disentangle the impact of the overall economic downturn from reductions due to improved water treatment processes and practices. In the end, the data on wastewater treatment did not permit conclusions about how much improvement was due to reduced inflows from industries cutting back on production and how much was due to treatment plant upgrades. There was no measurable economic impact on project participants or society from the watershed development project.

For the air quality improvement project, the only documented positive economic impact stems from the use of a diesel oil (boiler fuel) emulsification process at the Red October Steel Mill—not a planned intervention. Using waste fuel oil emulsification dramatically reduced mill fuel consumption, emissions, and wastewater discharge, reportedly saving approximately $2,000 per day in fuel costs. Based on interviews with resident engineers, the team concluded that this process had been widely replicated. However, the project's development and use of an electric arc furnace ceramic cover (delta), which had the potential to deliver economic benefits to the pilot mill (as well as to an additional 600 smelters across Russia), was never realized due to the inability to secure licensing for local production and the high cost of importing finished units from the United States.

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PROJECT PERFORMANCE

Project performance is assessed on the basis of effectiveness, sustainability, and replicability.

Effectiveness

Effectiveness is the measure of how well the development assistance met project objectives.

Overall, the wastewater treatment project was highly effective while the watershed development project appears to have been much less effective—with the surprising exception of its environmental education component. The wastewater treatment project promoted the transition from one-point or "grab sampling" to continuous automatic water sampling, using bought and donated reconditioned equipment. This technique allowed the pollution control authorities to develop an industrial enterprise "profile" to determine who was discharging illegally during nonmonitored periods. As a result of using automated sampling, treatment facility discharges were better managed—in some cases reduced significantly—and wastewater treatment facilities were better able to treat incoming industrial enterprise waste streams. In the majority of industrial enterprises visited, improvements were linked to project-provided equipment and technical assistance. Team visits confirmed that all three municipal sites had adopted and were continuing to use project-provided pollution control techniques and that water quality had improved.

Additionally, Russian wastewater officials were exposed to U.S. monitoring and enforcement methods and corresponding guidelines. This was accomplished through U.S. training and by joint industrial inspections in Russia. Joint inspections also led to better relations between industry and pollution control authorities. The use of monitoring equipment ended long, drawn-out discussions about discharges. As a result, the industries have begun to operate at the legal limit and notify the wastewater treatment facility if there are accidental discharges or "shock loads."

The watershed development project demonstration activities were not broadly implemented. An unstable farming and livestock sector, the relatively short-term nature of the project, and a difficult objective—altering lifetime agricultural practices—all contributed to only modest changes. The project introduced new methods, including data collection, measurement, and analysis. However, these new methods and the watershed management guidance manual produced by the project were insufficient to produce a better-functioning watershed—let alone serve as a model for replication. The Istra project successfully trained teachers and created an environmental curriculum, developing text for grades 2–5, 6–8, and 9–10, along with other environmental materials, teaching manuals, slides, and films. The project also established a local environmental NGO and worked with local media to spread the word on environmental issues.

The watershed development project demonstration activities were not broadly implemented. An unstable farming and livestock sector, the relatively short-term nature of the project, and a difficult objective … all contributed to only modest changes.

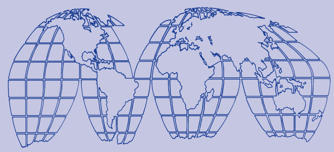
Overall, the air quality improvement project had mixed results, even after the scope of the project was diminished by considerably reducing its geographic focus and number of targeted industries. Project training and public participation accomplishments far outweighed those resulting from technological upgrades, equipment installation, or alterations in air quality monitoring techniques and procedures. For example, of the nine major components necessary for establishing an AQM program, the team found evidence of limited effectiveness for only four components: air quality sampling, emissions testing, public participation, and training. The team found no, or only weak, evidence of effectiveness for emissions inventory, human health and risk assessment, and compliance and enforcement components.

Sustainability

Sustainability is the degree to which a project continues to provide benefits after development assistance ceases.

Overall, the wastewater treatment project was highly sustainable. USEPA was well aware of the need for program sustainability and emphasized training, low-cost/no-cost methods, and institutional strengthening. Except in those circumstances where an industrial enterprise had closed, the team found strong evidence that almost all wastewater treatment activities were sustained at a high level three years after project completion. Local authorities were able to obtain funds for routine repairs of the project-provided or donated equipment. Wastewater efforts also contributed to financial sustainability as several water testing laboratories became certified, allowing them to perform private sector services for a fee—a growing source of needed income. Project-supported activities—such as joint training and automated sampling—strengthened institutional capability, which over time made it easier to resolve discharge-related conflicts. Wastewater treatment facilities and the industrial enterprises they served even came to be seen as partners in a process. The Smolensk Environmental Training Center's continued operation and ongoing outreach effort was further evidence of project sustainability.

In contrast, the watershed development project showed few signs of sustainability. Indeed, officials implementing the watershed development project rightly concluded early on that sustaining many of the demonstration activities would be difficult. Factors impeding sustainability included high project staff turnover, very unstable agricultural production, and restricted access to Moscow-area markets. The team observed that some of the project-built physical structures were still used by operating companies and farmers. However, the team did not find evidence that project-promoted management and agricultural practices took hold. Of the project's two livestock farms, both deemed major polluters, one closed during the project and the other sold off the majority of its animals. The team concluded that the project demonstration activities were undertaken in conditions that did not promise any real likelihood of sustainability. However, environmental activities focused on education took root and flourished. Many of the project-provided educational materials for schools were still in use; environmental education is still considered important and worthy of respect.



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Local interviews and onsite team inspection revealed that only two air quality improvement project components showed signs of sustainability—and that these were limited at best. For example, of the AQM systems introduced in Volgograd, local authorities could sustain only the few air sampling units that were easiest to operate and repair, required minimum maintenance, and had low operating costs. Local authorities could simply not sustain project-provided continuous air sampling equipment. The team also observed that this equipment was not in operation due to a lack of spare parts, calibration gases, and operator resources. The team judged that the emissions inventories effort could be sustainable, provided 1) local authorities review and integrate test data and annual operating report data into a database and 2) industry *truthfully* reports its emissions (experience showed emissions reporting was highly variable in accuracy and content). The team found little or no evidence for sustainability of other project-supported AQM program components, including source assessments, emissions testing (including visual emissions testing), human health risk assessment, and compliance and enforcement. Because the Russian Government did not officially accept some U.S. methods and procedures, the project's results were not defensible for compliance demonstration and enforcement purposes. Project training functions initially showed signs of success, but training revenues were not sufficient to sustain it.

Replicability

Replicability measures whether assistance provided has spread to other sites or locations.

Overall, the team found very limited replication of either the wastewater treatment or watershed development projects. Noteworthy exceptions included the wastewater treatment project's support for the Smolensk Environmental Training Center, which went on to train over 300 people who returned to nontargeted wastewater treatment facilities. The team also found evidence that some industrial enterprise staff were able to move water sampling and monitoring equipment located at one industry to another (Tver *oblast*). The project also resulted in equipping and certifying several nontargeted water quality laboratories. Of the watershed development project activities, only those supporting environmental education spread beyond Istra. Almost all schools in the Moscow *oblast*, for example, now teach environmental education using project materials. Environmental textbooks are now in their second edition and are being sold to schools throughout Russia.

Evidence of air quality improvement project-specific replication was extremely limited, with the exception of some boiler fine-tuning and fuel oil emulsification activities.

LESSONS LEARNED

1. Assess pollution control investments and incentives carefully.

USAID pollution project mangers need to carefully assess investments in low-cost/no-cost solutions to industrial pollution, particularly in situations where facilities and industries are seriously cash-strapped, and to consider additional incentives for initiating technology upgrades. In Russia, project managers emphasized low-cost/no-cost pollution control methods to improve air and water quality. In practice, "low-cost" and "no-cost" are misnomers; there were always out-of-pocket costs associated with any recommendation. For example, in resource-strapped and understaffed wastewater treatment facilities, buying even modest water sampling equipment was not possible, even when such costs were only a fraction of the operating budget. In-depth discussions with wastewater treatment facility, steel mill, and other industry operators revealed that the lack of even modest capital resources blocked them from adopting new methods, even when payback times were short. Faced with mounting operational problems and industry survival issues, managers were more likely to use new capital to maintain existing services and pay personnel.

Low-cost/no-cost solutions may also not prove durable. Much of Russia's industrial technology is so outdated that low-cost/no-cost solutions can only bring temporary and marginal improvement. Interviewees often commented that only completely new processes could produce significant environmental improvements. For example, venting and controlling emissions from Russia's open hearth steel furnaces would rarely make them economically or environmentally competitive with today's electric arc furnaces—simply a little cleaner. The plants will eventually modernize or close down; in either event, the earlier USAID low-cost/no-cost assistance will be lost.

2. Plan for replication from the start.

Pilot and demonstration environmental projects to curb water and/or air pollution will not be replicated unless replication is planned for from the outset. The projects produced little or no replication beyond the three targeted wastewater treatment facilities and key Volgograd industries. In 1992, USAID chose to work with a very limited set of pilot and demonstration sites because of Russia's enormous environmental challenges, vast area, unstable regulatory situation, government fragmentation, and project budget constraints. Little time was spent considering how USAID's projects would spread to other wastewater treatment facilities and industrial enterprises in other cities. Working with pilot sites one-on-one did not result in replication. When the regulatory pressure is either low or nonexistent, other wastewater treatment facilities and industries will not feel compelled to adopt new procedures and processes. Thus, replication plans must be integral to project design—even at the implementation stage.

Suggestions to improve replicability included placing stress on the financial benefits. Facility managers, especially in Volgograd, suggested that providing industry with rate-of-return information could spur interest in adopting environmental technologies. Simply presenting an industrial enterprise (steel, aluminum, or brickmaking) with the "facts" did not help the firm adopt any new technology. Furthermore, in a market economy (as Russia is becoming), there is no incentive—some would say there is a disincentive—for any firm to share new technology with others. To overcome this industrial inertia and achieve replicability, project planners should carefully and deliberately present financial benefits, including convincing return-on-investment information on 1) reduced fees and fines associated with lowering emission levels, and 2) increased profits through the recovery of materials that can be recycled back into the production process.

3. Use appropriate—but not necessarily new or state-of-the-art—methods, procedures, and technologies.

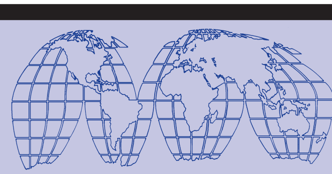
Project-furnished technology and methods have to reflect local operating conditions. USAID's implementers provided technical advice to improve municipal water quality operations and industrial air pollution mitigation. Especially as part of the air quality improvement project, project designers emphasized getting the "best pollution equipment." However, the right equipment and the right expertise, both necessary for a sustained impact, did not come together as well as expected. Why? In-depth interviews and onsite visits revealed that too little attention was given to the operating environment for this equipment.

Understanding and appreciating the operating environment requires that project implementers must carefully examine 1) the availability of trained staff and other necessary support services (including operations, equipment calibration, preventive maintenance, and repair) and expendable supplies necessary for continued operation of the device or equipment; 2) the physical environment, including exposure to elements, pollutants, and abuses inherent to the application; 3) the regulatory and legal acceptability of methods and procedures; and 4) the level of precision, accuracy, and spatial and temporal resolution. The team found that design and implementation staff focused too much on state-of-the-art equipment and not enough on what was needed to make things work better in Russia.

Volgograd plant interviews revealed that operational funding beyond the initial capital cost of pollution prevention equipment was not seriously considered. Activity designers must ask whether there is enough funding to obtain initial governmental certification, cover testing costs, and ensure a product market if replication is desired.

4. Consider both short- and long-term tradeoffs.

USAID must be clear whether it seeks shorter term results, with more immediate and visible outcomes, or longer term results, with sustainable impacts and more durable institutional partners. The umbrella environmental program was officially launched at a time when the U.S. Government was moving swiftly to be among Russia's first supporters. There were political and financial reasons to promote early project successes, and work with selected wastewater treatment facilities and polluting industries was highly visible. USAID relied heavily on USEPA technical expertise to take the lead because of its demonstrated expertise and well-established Russian contacts. Team interviews revealed that USEPA-led activities started up later than planned, but USEPA established an early presence at key sites.



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More lead time for project startup and host-country needs analysis would have improved communication between the U.S. and Russian partners and otherwise allowed for a more sustainable effort. Better planning might have produced more widespread and sustained impacts, but at the expense of higher U.S. visibility early on and less spending. Durable partnerships and well-functioning environmental institutions take time to coalesce and mature to fully operational status, especially in transition countries like Russia, where environmental institutions are both understaffed and underfunded.

Interviews with water and air quality officials confirmed the need for onsite engagement, not occasional visits with concentrated bursts of activities. Institution building and strengthening require a slow, steady effort and long-term, onsite presence. USEPA was often not able to provide this kind of support. Modifying institutions and changing people's behaviors require dealing with problems and overcoming obstacles before or as they arise, and learning through observation—which may not take place only when advisors just happen to be in country. Finally, some interviewees suggested that the typical kind of leveraging that USAID works hard to secure was partially undermined by the lack of a sustained on-the-ground presence in Russia.

5. Collect appropriate data to assess project results.

Collection of baseline data and other appropriate information is needed to assess project impacts. Baseline and other data were not systematically gathered to permit an unambiguous assessment of the effects of the various upgrades at the three wastewater treatment facilities or key industrial enterprises. It was not possible to fully disentangle the effect of facility improvements from the impact of the economic downturn that led to decreased industrial waste streams, or from factors that would have produced similar outcomes. Similarly in Volgograd, sufficient data was not collected to accurately assess changes in pollution emissions, nor were other standardized measures in place to permit assessment of progress in implementing a model air quality improvement project. Lack of good baseline data and the inability to link facility and industry upgrades with specific project inputs undermined USAID's ability to conduct accurate project appraisals.

This Impact Evaluation summarizes a Working Paper prepared by Steve Gale, of CDIE, with team members Matthew Addison, Mark Hodges, and Nick Wedeman. This Impact Evaluation and the Working Paper (PN-ACM-154) can be ordered from USAID's Development Experience Clearinghouse (DEC). To download or order publications, go to www.dec.org and enter the document identification number in the Search box. The DEC may also be contacted at 1611 North Kent Street, Suite 200, Arlington, VA 22209; telephone 703-351-4006; fax 703-351-4039; e-mail docorder@dec.cdie.org. Steve Gale prepared this Impact Evaluation, and IBI (International Business Initiatives, Inc.) furnished editorial and production assistance.