Using Economic Incentives to Control Pollution in Russia

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Foreword

This Working Paper is a product of the Environmental and Natural Resources Policy and Training (EPAT) Project funded by the United States Agency for International Development (USAID). EPAT is part of USAID's effort to provide environmental policy information to policymakers and practitioners in developing countries. The objective is to encourage the adoption of economic policies for promoting sustainable use of natural resources and enhancing environmental quality.

EPAT Working Papers are written for development professionals and policymakers in developing countries who are responsible for establishing and implementing policies on the sustainable use of natural resources and for civil servants, project officers, and researchers who are directly involved in the implementation of development activities.

This Working Paper deals with the system of environmental management in Russia with a focus on economic incentives for the control of air pollution. Initial conclusions indicate that the economic incentives being used are very weak. Nevertheless, several positive results were identified from the pollution fee system. Urban planners in developing countries may find some of the results of this effort applicable in their own situations as they try to solve urban air pollution problems.

The contribution of USAID toward writing, printing, and distributing this document is estimated to be $8,500. The document is being distributed to more than 2,000 policymakers and professionals in developing countries. We will assess its effectiveness by soliciting the views of recipients. An evaluation sheet is enclosed with each mailing of EPAT publications for that purpose.

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Abstract

This paper investigates Russia's system of environmental management, especially economic tools used to control pollution. It also describes the Russian experience with a system of pollution fees. In particular, we consider how the system of pollution fees works, how fee levels are set, the incentive properties of the fees, and the ultimate use to the Russian government of the revenue from the emission fees. Although the emission fees are quite substantial for some pollutants, the incentive properties of the fees are almost nonexistent. The primary purpose of pollution fees is to generate funds for state-owned enterprises to invest in pollution abatement equipment. This is substantially different from the operation of a pollution fee in the West.

Acknowledgement

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Contents

Introduction

This paper investigates Russia's system of environmental management, especially economic tools used to control pollution. It also analyzes the process by which Russia formed and operates a system of pollution fees. Our analysis covered four years, beginning in 1989 with the USSR's two-year experiment with pollution fees in approximately 50 regions. It ended in 1993 when a system of pollution fees was in operation throughout Russia. We focus on air pollution, identifying existing liability mechanisms for environmental problems and analyzing economic incentives for regulating environmental pollution.

An administrative system of environmental management that corresponded to the Soviet system of economic regulation existed in Russia until 1990. Then economic reforms eliminated this mechanism and forced the government to structure a new regulation system based on economic tools. We try to answer these questions:

- What incentives entice polluting enterprises to reduce their emissions?
- What are the positive outcomes of this system?
- What will increase its efficiency?

Of course, the system has not been operating long enough for an in-depth analysis. Therefore, we compensated for a lack of empirical data by analyzing indirect factors and experts' estimates. Even with these shortcomings, this investigation is important as Russia incorporates environmental protection into its emerging free market system. Soon, the only tools for assessing environmental liability will be legalized economic mechanisms linked to a system of environmental standards.

As privatization gives many rights to new owners, there is a danger that the balance between the rights of these owners and their environmental liabilities will shift to favor business. Weaknesses within the economic and legal systems could contribute to this shift. If this occurs, the environment will be the loser. Does the existing system of fees create sufficient incentives for firms to invest in environmental protection? Are there more effective ways to encourage businesses to maintain environmental standards? Answers to these questions must take into account the market system now forming in Russia. This work is an attempt to use United States methods to analyze the Russian system of managing environmental protection.

The Command-and-Control System of Environmental Management

Formerly, the USSR used a command-and-control system of environmental regulation. It involved a centralized determination of exactly what pollution control measure each firm or factory must adopt. This system of environmental management consisted of several elements:

- a system of environmental quality standards,
- a system for planning and financing environmental controls, and
- a system for monitoring and controlling environmental quality.

Several legislative acts established the main features of the command-and-control system and spelled out the responsibilities of various environmental protection ministries and organizations. Beginning in 1968, the USSR Politburo adopted several fundamental acts[1] governing the exploitation of the environment and natural resources:

- the Fundamental Land Management Act of 1968,
- the Fundamental Water Management Act of 1970,
- the Fundamental Mining Management Act of 1975,
- the Fundamental Forests Act of 1977,
- the Atmospheric Air Protection Act, and
- the Wildlife Protection and Utilization Act of 1980.

The USSR leaders set their environmental protection goals in the 1969 Fundamental Public Health Act. *The Constitution (The Main Law) of the USSR* first mentioned the necessity of protecting the environment in 1977.

The System of Environmental Quality Standards

In accordance with the Public Health Act (USSR Supreme Soviet: 1969), the Ministry of Public Health devised and adopted environmental quality standards. Ambient standards played a key role. In the

USSR, the system of standards was the Maximum Permissible Concentration of hazardous substances in the ambient environment (atmosphere, reservoirs, and soils).

Introduced in 1969, the standards assumed that pollution at Maximum Permissible Concentration levels corresponded to the maximum amount of pollution the atmosphere could absorb without causing damage to the environment or to people. The Ministry has set these standards for more than 200 substances. Examples of average daily Maximum Permissible Concentration standards for urban areas (in mg/m^3) include:

- sulphur dioxide - 0.05,
- chlorine - 0.03,
- hydrogen sulfide - 0.008,
- carbon monoxide - 3.0,
- nitrogen oxide - 0.04, and
- particulates (nontoxic), 0.15 (USSR Statistical Committee: 1989-1990).

The Ministry established these standards based on medical requirements without concern for economics or other factors. The standards are more severe than those in many other countries (Russian Statistical Committee 1994)[2] and are mostly unattainable. According to 1980s data, polluting enterprises exceeded Maximum Permissible Concentration standards by an average factor of 2.5 or two and a half times worse than the law allows.

The cities of the former USSR had the most severe problems. For example, 16 large towns exceeded the Maximum Permissible Concentration for dust emissions by more than 3 times as much as the law allows.[3] Fourteen cities exceeded sulfur dioxide standards by a factor greater than three.[4] According to the Atmospheric Air Protection Act (USSR Supreme Soviet 1980), cities could attain Maximum Permissible Concentration levels by specifying Maximum Permissible Levels of emissions for stationary pollution sources. The act also established standard concentrations of harmful substances for mobile emission sources. But the act only controlled auto emissions of carbon monoxide. Automotive fuel standards regulated lead and sulfur emissions.

These permissible levels applied to new as well as operating businesses. The State Hydro-Meteorological Committee and the Ministry of Public Health calculated the standards. The Atmospheric Air Protection Act introduced the standards to the USSR[5] on Jan. 1, 1980. But as with Maximum Permissible Concentrations, the Ministry enacted Maximum Permissible Level standards without considering the economic situation. They proved more optimistic than realistic. As emissions continued at substantially higher levels than marginal standards, the Soviet Ministry recognized that strict permissible level observance would force most industries to close.

To prevent the accompanying economic upheaval, the USSR Council of Ministers adopted, by special decision, Temporary Coordinated Levels of emissions (USSR Council of Ministers 1980). These policies made it possible for enterprises to gradually cut back emissions to comply with the

permissible level. Policymakers developed special emission reduction programs for large enterprises. These programs also considered all abatement costs. These temporary policies, therefore, represented a compromise between environmental and economic goals. Initially, the Ministry fixed marginal permissible levels of emissions and Temporary Coordinated Levels of emissions for the largest enterprises only. Only 14 to 18% of all polluting enterprises had such standards from their introduction until the start of the pollution fee experiment.

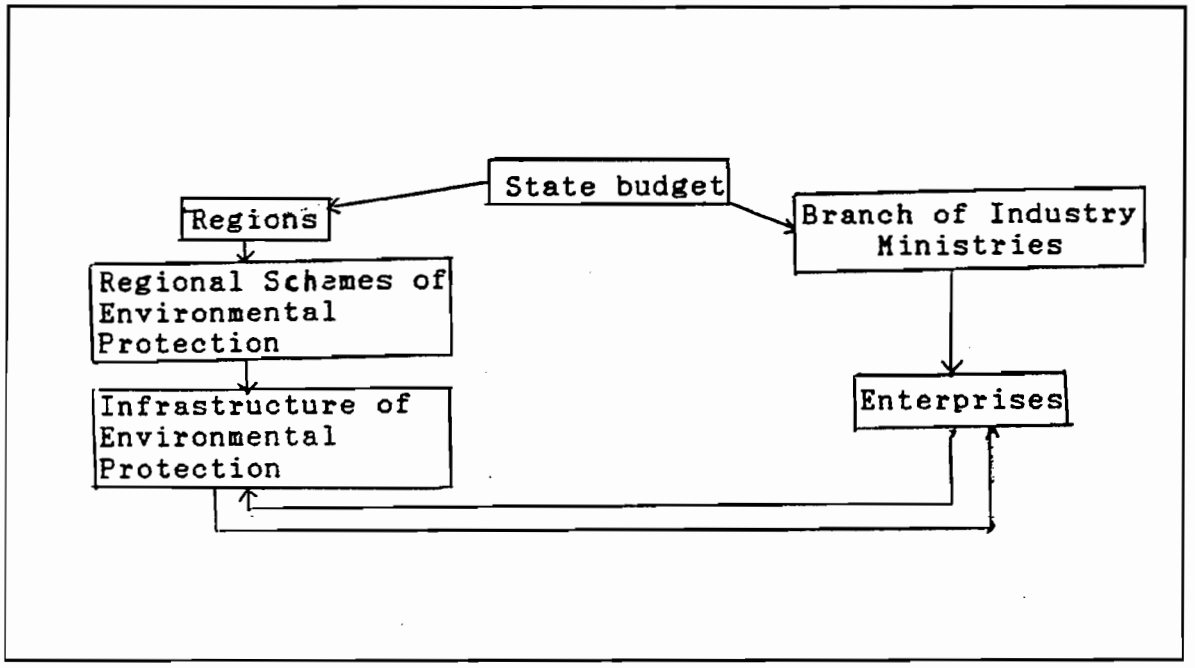
The System of Planning and Financing Environmental Efforts

Beginning in 1982, environmental planning became part of business production plans, general city development plans, and regional industrial location and development schemes. Plans included the step-by-step attainment of Maximum Permissible Levels for each enterprise. Polluting enterprises needed to first achieve the temporary levels and then, gradually, the maximum. Thus, all affected enterprises had to build special investment limits into their production plans. These investments were their main abatement activities and had to be sufficient for them to first reach the temporary and then the maximum levels. They were worked out by corresponding Ministries of the USSR and Soviet Republics on the basis of executive authorities of regional and local legislatures. A draft document for a 15-year environmental protection and rational natural resource use program incorporated the concept. This Long-Term Ecological Program went into effect in 1990 with the goal that all Soviet enterprises would comply with Maximum Permissible Levels by 2005 (USSR State Committee on the Scientific and Technological Development 1980).

From 1981 to 1990, different regions and towns developed one- and five-year abatement activity and economic development plans. The USSR State Planning Committee set state investments for environmental protection. It recommended the Long-Term Ecological Program as the primary environmental document. And the Regional Complex Schemes of Environmental Protection established the groundwork for the Program. Since 1984, these state-financed schemes were the primary environmental documents for the most polluted regions such as Lake Ladozhskoe and Lake Baikal. The schemes stipulated that abatement costs for enterprises would be separate from expenses.

Funds for abatement were allocated to enterprises from the budget of a corresponding branch of a Ministry after its budget was coordinated with the state organizations responsible for environmental protection. The state agencies included the Ministry of Agriculture, Ministry of Forestry, Ministry of Water Management, Ministry of Fish Resources Management, State Committee of Hydro-Meteorology, Ministry of Public Health, Ministry of Energy, and the State Committee for Mineral Deposits. Funds for improving the infrastructure, such as sewage systems, came from local budgets and contributions from industry seeking to build new production facilities. Thus, the State Planning Committee of the USSR determined the total abatement costs. The Committee distributed part of the money among ministries that, in turn, distributed it proportionally among enterprises that had filed claims. The Committee then distributed remaining funds among the regions. Further, enterprises could take abatement expenses from the regional environmental program resources. The funds increased after 1984. Also, enterprises could allocate their resources for infrastructure construction (see figure 1).

Figure 1. Allocation of Money for Environmental Uses



The reallocations were intended to help industries attain environmental standards. Every year, the appropriate ministry informed enterprises about their emission reduction goals. The ministry also instructed them about their corresponding investments and limits on using investment resources such as capacities of construction organizations and materials. In this way, the government planned financial and physical aspects of environmental control.

After the USSR Council of Ministers Environmental Protection decision in 1978, all construction projects had to meet certain environmental standards. Officially, large projects had to undertake an Environmental Impact Assessment. However, the USSR State Construction Committee really decided what environmental requirements they had to meet.

Finally, in 1989, policymakers consolidated environmental expertise into the State Environmental Committee. Before then, the State Planning Committee and State Construction Committee of the USSR performed similar functions.

Monitoring Environmental Quality and Control

Policymakers assigned the tasks of monitoring and controlling environmental quality to the state organizations mentioned earlier. The State Committee for Hydro-Meteorology became responsible for

monitoring ambient pollution levels. The Ministry of Public Health dealt with toxins and hazardous substances including food contamination. Before the State Environmental Committee's formation in 1989, these ministries were responsible for controlling air quality. They were responsible for establishing Maximum Permissible Levels and Temporary Coordinated Levels, controlling compliance, granting emission permits, monitoring the environment, and providing dissipation information.

These ministries had inspection services with limited rights to penalize polluters. After a 1982 decision by the USSR Presidium of Supreme Soviets, they became the primary administrative units for protecting air quality. Their enforcement tools included penalties (a maximum of 100 rubles), with the official ruble exchange rate at 1 ruble = $1.6 US, criminal proceedings (rarely), and business closures (almost never).

Estimating the Effectiveness of the Command-and-Control Management System

As many Russian specialists have mentioned, the command-and-control system of environmental management, which lasted from 1980 to 1991, did not create sufficient incentives to improve abatement activities. Nevertheless, since 1980, harmful air emissions have declined steadily despite increases in the production of goods (see table 1).

Table 1. Comparing Changes in Harmful Emission Volumes and Produced National Income in Real Prices

	Former USSR								Russia	
	1976	1980	1985	1986	1987	1988	1989	1990	1991	1992
Total emissions from stationary sources (mil. ton)	76.7	72.8	86.3	66.5	64.3	61.7	59.6	62.2 (34.1)+	31.8	28.2
GNP (bil. rubles)	525*	619	777	799	825	875	943	1000 (644)**,+	1300	180
Deflator								108.6	90	2500

* Estimated

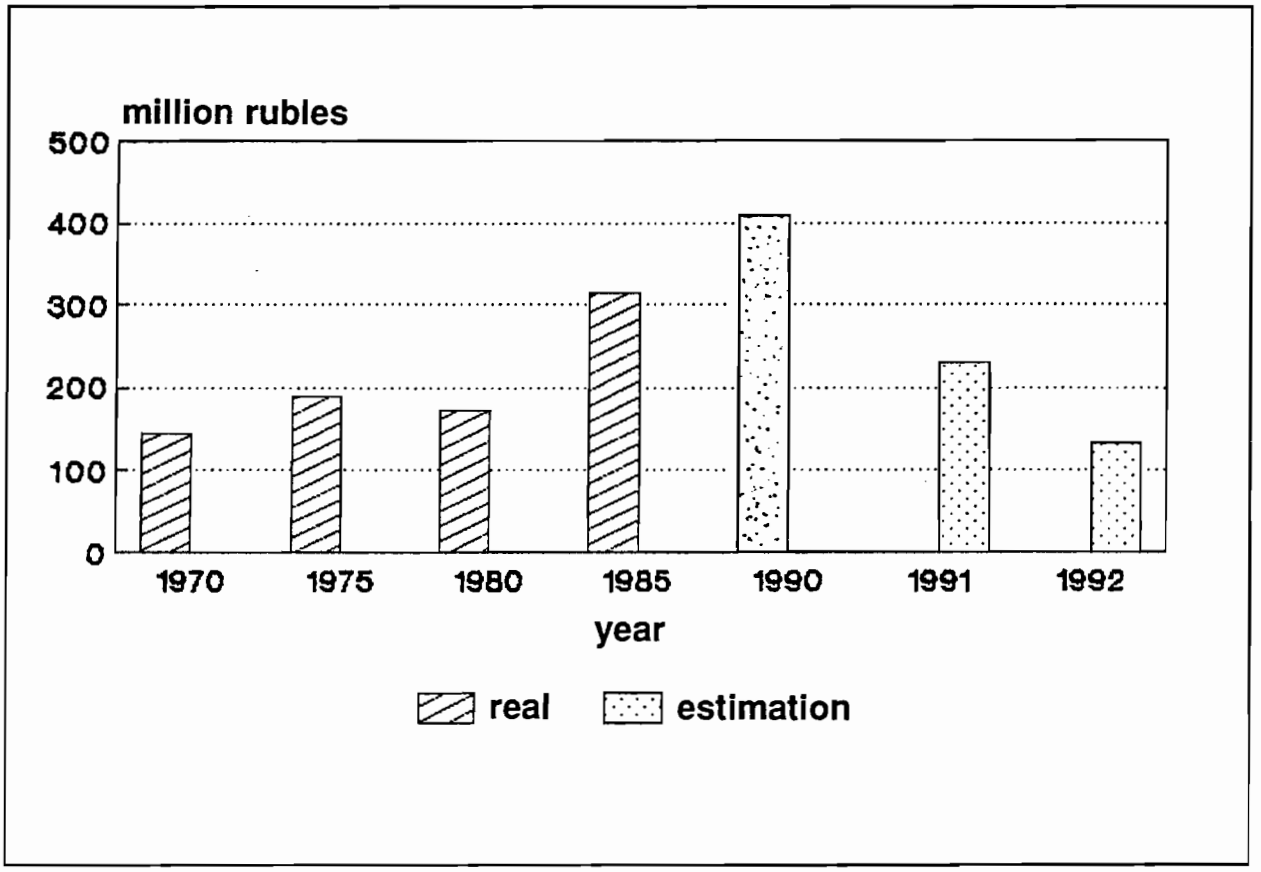
** For Russia, only Gross Domestic Product is represented in the statistical surveys. It is approximately equal to the Gross National Product for Russia.

\+ Russia

Source: Calculated on the basis of USSR Statistical Committee 1985, 1988, 1989, 1990

We believe the 1990 emission increase could be the result of better monitoring and more complete analyses following the USSR's pollution fee experiment. The pollution abatement investment data in figure 2 show, in real prices, that investments grew from 1976 to 1979, declined between 1980 and 1985, then grew again until 1991, and have been falling ever since. To understand the reductions from 1980 to 1985, consider the cost dynamics of creating and installing special equipment that captures gases and renders them harmless.

Figure 2. Environmental Protection Investments for the Former USSR (in real prices)



Base year for prices: 1984

Source: USSR Statistical Committee, 1985, 1988, 1989, 1990, 1992, 1993

Table 2 shows that the number of air pollution abatement facilities built and installed dropped between 1981 and 1985 compared with 1976 to 1980. At the same time, the minimum specific abatement capacity cost per unit was a low 4.5 rubles/m^3/hour for gas. The cost per unit decrease for absorbed gases from new Temporary Coordinated Levels presented an opportunity to account for the marginal abatement cost curves for each pollution source. Thus, emission reductions were distributed among enterprises more efficiently.

Table 2. "Investment" in Air Pollution Abatement

Period	1976-80	1981-85	1986-90	1990	1991	1992
Gas Abatement Facilities (per million cubic meters of gas/hr.)	20.4	20.0	22.5	16.4	8.2	5.6

Source: Tietenberg 1992

Abatement investments grew between 1985 and 1990 because the Regional Complex Schemes of Environmental Protection enacted in 1984 began to take effect. Businesses required additional investments to comply with the schemes. Regional channels for distributing centralized environmental investments supplemented industrial ones. The federal budget provided resources through the ministries and regional budgets. This period was the peak of the command-and-control management systems.

Command-and-control corresponded to the general planned economic management system. Its disintegration in 1991 and 1992 corresponded with that of the planned economy. If command-and-control had continued, the Maximum Permissible Levels fixed by the Long-Term Ecological Program (USSR State Committee on the Scientific and Technological Development 1980) would have been achieved by 2005. But they would have needed many more abatement investments. Experts estimated that abatement investments would have had to increase 2.2 to 2.9 times (USSR State Committee on the Scientific and Technological Development 1980). Though the command-and-control system produced some positive results, it was expensive. The systems of environmental planning and management did not encourage businesses to seek the cheapest methods to comply with Maximum Permissible Levels.

Although command-and-control did not solve the former USSR's environmental problems, it did prevent some deterioration of environmental quality. Its influence on polluting enterprises was marginal, yet tangible. How will the disintegration of command-and-control affect environmental protection? Is the influence of the new system, just now taking shape, comparable to the old? What will happen to pollution dynamics after the Russian economic crisis?

In 1988, All-Union and Russian Environmental Committees began to manage pollution control. In 1989, the All-Union Committee organized an experiment for introducing pollution fees. In 1991, the pollution fees began to operate throughout the former USSR. Also in 1991, the Russian Environmental Committee became the Ministry of Environmental Protection and Natural Resources, and its responsibilities increased. In 1992, policymakers adopted the Russian Law on Environmental Protection, and the Ministry continued to create modern institutions and mechanisms for environmental management.

The 1989-1990 Experiment

At the end of the 1980s, policymakers realized that command-and-control would not survive the transition to a market economy. Transition to a new system of managing environmental protection became an obvious need. Why did a command-and-control system operate successfully in the United States market economy but fail in the USSR? The reason lies in the differences in the command-and-control systems. In the United States, the government concentrated on setting ambient and technological standards, then worked with the judicial system to enforce them. In contrast, the Soviet government emphasized abatement investments. Although policymakers in the USSR set emissions standards, they were seldom met. The basis of the Soviet command-and-control system was centralized materials and financial provisions for environmental investments. Therefore, when the system of centralized planning and finance collapsed, so did the command-and-control system.

The Soviets recognized that their administrative mechanism for controlling pollution was inefficient and likely to become more so. Its scientists and managers also knew that during the transition to a market economy, they badly needed to create new methods of environmental protection. As a result, the USSR State Environmental Committee began a system of pollution fees for air pollution, water pollution, and solid waste disposal. From 1989 to 1990, they conducted an experiment involving about 50 former USSR regions, including many severely polluted cities such as Moscow, Dnepropetrovsk, Zaporozhje, and Nizhny Tagil.

The Committee carefully planned the experiment to provide representative results. The participating regions varied in their geography, climate, natural resources, economic conditions, industries, and population. In Russia, for example, researchers conducted the experiment in such cities as Moscow and St. Petersburg which have:

- 10% of the population,
- most industrial production, and
- pollutant emissions (except carbon dioxide) at 1,153,000 t/yr. (Moscow) and 608,300 t/yr. (St. Petersburg).

Tver, Vologda, Cherepovets, Kostroma, and Jaroslavl from the European region of Russia also participated. Several of these cities are industrialized and polluted. In Jaroslavl, emissions average 309,700 t/yr. In Cherepovets in Vologda region, home to Russia's biggest metallurgical plant, emissions reach 741,700 t/yr.

Though most of the regions were in Russia and the Ukraine, researchers assured geographical diversity by including the Siberian regions (Kemerovo, 202,000 t/yr. of emissions and Nizhniy Tagil in the Ural, 668,500 t/yr.). Regions containing unique natural objects, such as the Irkutsk region which contains Lake Baikal, also participated. Annual emissions in Irkutsk average 156,600 t/yr.

The legal basis for the experiment was a decision by the USSR Council of Ministers. Local authorities resolved questions of regional participation. Although central and local Soviet authorities endorsed the experiment, they actually had no legal foundation for imposing effluent fees. Enterprises could, and often did, refuse to pay. Therefore, environmental authorities had to find indirect ways to control such enterprises. One way was to require them to submit projects to an environmental authority for approval. The authorities could withhold their approval until the enterprise had paid all of its outstanding pollution fees.

During the experiment, the government tested several methods for calculating and collecting pollution fees but preferred two. The first method measured economic damage, and the second calculated regional environmental management costs.

The Problem of Damage Estimation: Pollution Fees

Damage estimation was the basis for the first method for calculating pollution fees. The Central Economics and Mathematics Institute in Moscow and the Sumskoy (now Ukraine) Physical-Technical Institute led the efforts to develop estimates for economic damage from environmental pollution. The foundation for these investigations were cause-and-effect analyses. In these types of analyses, researchers try to trace emissions of harmful substances from their sources to their concentration points in the atmosphere (reservoir) to real damage and ultimately to economic damage (Russian Statistical Committee 1994, State Committee of the USSR for Science and Technology 1983, and Gofmana 1977). Russian economists working with biologists, physicians, and meteorologists had conducted these cause-effect analyses for more than 20 years.

The first step in these analyses examined the total volume and structure of emissions. They used dispersion models to measure concentration. For atmospheric emissions, the researchers considered such factors as the source location, the pipe height, wind direction, and topography.[6] They calculated dissipation for projected new emissions sources to estimate their influence on economic activity.

Using concentrations of harmful substances, they estimated the real influence of the pollutants on the environment and the economy. To estimate damage, they considered the following types of influences:

- worsening quality of life (including recreation, health, and mortality),
- diminishing service life of real assets such as buildings,
- increasing concentrations of hazardous substances in air (or water) used in production, and
- diminishing agricultural crop capacity and slowing forestry biomass growth.

From empirical data, they constructed functional dependencies between concentrations of harmful substances or emissions and values of physical indices such as cooperative productivity. The Sumskoy Physico-Technical Institute conducted most of these investigations. Last, researchers introduced monetary valuations of physical loadings on the environment into the analysis.

This approach toward calculating pollution fees was very complicated to put into practice. First, the USSR regulated all prices. Therefore, prices did not reflect the economic value of resources. This pricing policy contradicted the laws of the marketplace. For example, agriculture had differentiated purchase prices in order to extract excess profit with the help of prices. Under this system, if land costs in regions A and B were equal but soil productivity in region A was twice that of region B, then the purchase prices in region A were twice those in region B. This plan required farmers to sell their crops to the state. This system of pricing is, of course, impossible to use in assessing damage.

The second reason it was difficult to estimate damage from pollution was that the objects of evaluation included health and mortality. It is difficult, even in a market economy, to find adequate economic indices to evaluate these factors.

The further development of methods for estimating economic damage from pollution followed two directions. First, work has continued on detailed, sector-specific, damage estimates. For example, to estimate harvest losses, researchers calculated marginal costs. To estimate health losses, they calculated the costs of preventing disease. Alternatively, they proposed an approach that uses a simpler, standardized method of estimating damage. In this approach, researchers assumed damages to be proportional to aggregate emissions. They used proportionality factors to develop several techniques.

Policymakers can find explanations of the various methods of calculating coefficients in different books (Gofman and Gusev 1977). But beginning in 1983, researchers assembled these methodologies and published them in the *Rules for the Damage Estimation* (Gofman, Gusev, and Balatsky 1986; and Gofman, Gusev, Balatsky, Golub, Lemeshev, Mudretsov, and Ushakov 1987).

The standard way to calculate damage is by using a single formula:

$$\mu = \gamma\sigma M \qquad (1)$$

where μ is estimation of damage; γ is monetary assessment of one ton of conventional aggregated emissions; σ is a special coefficient for accounting for regional features, and M is an index of aggregated emissions. Further,

$$M = \Sigma_i \, A_i m_i \qquad (2)$$

where m_i is total volume of the i-substance emissions and A_i is the coefficient of comparable danger of the i-substance. The guidebook mentioned above lists all possible meanings of A_i in equation (2) (Rules 1986, 1987). By means of the A_i, one could aggregate various harmful substances and discount them to conventional types of emissions. There are different ways to define the A_i. The first approach sets the A_i to the reciprocal of the Marginal Permissible Concentration of the pollutant. An alternative approach takes into account more complicated correlations between pollution and human health, pollution and land fertility, and so on. Explanations of the methods for calculating coefficients A_i, γ are elaborated elsewhere (Gofman and Gusev 1977).

Thus, it is possible to use the *Rules* for point sources of pollution, and on this basis, calculate approximate levels of damage. These methods for calculating damages are guidelines and may differ dramatically from more rigorous case-by-case assessment of damage levels. The rules have the advantage of simplicity and ease of use.

All empirical attempts to evaluate γ failed. For that reason, economists proposed to set γ to the economy-wide aggregate marginal abatement cost (capital costs). For example, for the period 1982 to 1985, they proposed to let γ equal 2.5 rubles/t of conventional emissions. It was to increase 3 rubles/t over a 5-year period. Then γ was approximately equal to the marginal abatement cost. Because this formula measures control costs and not damages, economists could not use it for calculating the level of abatement cost efficiency. But the approach's simplicity resulted in its being actively used during the late introduction of a pollution fee system.

Second Method of Calculating Fees: Sharing Abatement Costs

The existing methods for calculating pollution fees have several problems. The worst problem is that none of the damage payments, in the cities using this method, have correlated with the calculated damage value because enterprises have been unable to pay. For that reason, economists have proposed a second approach for calculating pollution fees. This new approach first defines the cost necessary to realize a program of regional pollution control (K). Next, the government calculates payments for each polluter based on its share of abatement costs:

$$P_j = K\, M_j/M \qquad (3)$$

where P_j is emissions fee, M_j is emission of the j-polluter, and M is total emissions.

The payments calculated by formula (3) were 10 to 15 times lower than the level of incurred damage calculated using damage estimates. Two case studies illustrate the two approaches. One method was used in Vologda, the other in Moscow. The following explanation clarifies the difference between the first and the second approach.

To calculate the value of conventional emissions, we used equation (2). If we compare formula (1) and (3), then γ is the marginal abatement cost and K/M is the average abatement cost. If the function of abatement cost is linear, then γ and K/M coincide.

In recent years, experts' estimates prevailed in direct methods of damage calculation. One of the latest examples is an expert's damage estimate from a national report about the Russian environment.

To create the necessary incentives for enterprises to curtail emissions, the government proposed a special system of limits. For emissions within the standard, they calculated payments using formula (1) or (3), yielding a common tariff. They assessed emissions exceeding the limits at a higher penalty tariff. They set each plant's tariff individually. It was equal to the ratio between the investments the enterprise needed to reduce emissions to the Temporary Coordinated Level and the total amount of emissions needing reduction.

They defined the penalty ρ_j as

$$\rho_j = \frac{\Delta K_j}{\Delta M_j} \qquad (4)$$

where ΔK_j is investments foreseen for the *j*-enterprise for emissions reduction by the amount ΔM_j. They levied the fee ρ_j on the difference between actual emissions and the Temporary Coordinated Levels.

The main reason for calculating fees based on formula (3) lies in its construction. That is, the government calculated the cost to meet environmental goals for each locality. The costs differ from region to region. To calculate penalties, one should know the cost for each enterprise. Unfortunately, obtaining such data is nearly impossible. Therefore, in 1992, policymakers simplified the method. The Russian Council of Ministers decided to adopt single payment rates for the entire Russian territory although the rates may differ according to local policy. However, local authorities could use different approaches for different polluters, especially when they took into account regional conditions.

The experiment demonstrated that it was possible to determine and sometimes collect pollution fees. But it also revealed numerous implementation problems. The main problem was not having a legal basis for collecting fees. The executive decision was an indirect basis for collecting them. Therefore, it did not stand up in legal actions against polluters who refused to pay. Even so, beginning in 1991, Russia implemented pollution fees throughout the country.

Russian System of Pollution Fees in 1991

In 1991, the Russian government introduced fees for stationary and mobile air pollution sources, water pollution, and solid waste disposal.

Legal Basis

A 1991 decision by the Russian Council of Ministers established the legal basis for pollution fees and their implementation. The decision adopted fees for 1991 and stressed it would collect fees from all polluters independently of their institutional position whether government-owned or private. The decision opened the possibility of reducing some regional fees due to environmental and economic conditions by negotiating among parties and adopting to local conditions. It made a special provision to include environmental protection costs in their calculations.

Fee Rates

Supplements to the decision included rates of fixed fees. There were two rates for water and air pollution--one for emissions below the limit and another for emissions above the limit. Fees for above-limit emissions were five times greater than for below-limit emissions. Tables 3 and 4 show fee examples. The decision established pollution fees for atmospheric emissions of 211 substances.

Table 3. Fees for Selected Air Pollutants, 1991

Pollutant	Fee rate (rubles/ton)	
	allowed emissions	above-limit emissions
NO	55.01	263.39
SO_2	66.00	316.00
Pb	10,999.89	52,666.14
Dust (timber, lime, coal)	22.01	105.39
CO	1.09	5.21
Benzopyrene	3,300,000.00	15,800,000.00

Source: Russian Council of Ministers 1991

In the same way, the decision fixed water pollution fees for 92 pollutants on the basis of two rate types (table 4). It also fixed fees for above-standard emissions for 33 pesticides. The Council of Minister decision did not levy fees on technologically-approved amounts of pesticide because of unstable economics in agriculture.

Table 4. Fee for Selected Water Pollutants, 1991

Pollutant	Fee rate (ruble/kg)	
	below-limit discharge	above-limit discharge
Aluminum hydrate	8.870	46.934
Aniline	4,435.000	23,467.000
Vanadium (V)	443.500	2,346.700
Oil	44.350	234.670
Arsenic	8.870	46.934
Phosphates	17.740	93.868

Source: Russian Council of Ministers 1991

For mobile sources, the Council calculated the fee per ton of fuel. Fees were 6.83 rubles/t for diesel fuel, 5.10 rubles/t for petrol without lead, and 8.40 rubles/t for petrol with lead. The price of one ton of retail petrol was 400 rubles/t, with the fee representing 2.1% of the price. The price of wholesale petrol was about 1200 rubles/t, with the fee comprising 0.7% of the price.

Finally, the Council decision set fees for solid waste disposal, dividing the wastes into four classes according to their risk. Disposing of one ton of solid waste at the highest risk level cost 100 rubles. Nontoxic solid wastes cost one ruble/t.

The essential feature of the pollution fee system was its uniformity, independent of location. But, the regions had different abilities to absorb and compensate for pollution. For that reason, the Council introduced a special correction factor, similar to γ in equation (1), to account for regional differences. Policymakers multiplied the previously-mentioned pollution fees by the correction factor. For air pollution, the country was divided into 11 regions. The Far Eastern Region had a correction factor of one for air pollution. The Ural Region had a correction factor of two. For water pollution, policy-makers divided the area into 99 water regions.

Correction factors solved only part of the problem. As mentioned earlier, one of the main goals of the pollution fee system was to create independent funding sources for regional environmental programs. For that reason, policymakers linked fee rates with regional financial demands.

Environmental Funds

The system of environmental funds had three levels: local, republican (regional), and federal. According to 1991 data from the Environmental Protection and Natural Resources Ministry, the government collected about one billion rubles as pollution fees, penalties, and compensation for environmental damage. The main source was the fee for allowed pollution (65%). Above-standard pollution fees constituted 14.8%, actions - 9.3%, penalties - 2.6%, and other sources - 8.6%. Penalties and compensation constituted only 12% of the total. Clearly, fees for allowed pollution became the main source of environmental funds. In 1991, the government transferred 25.1 million rubles (2.6%) to the federal environmental fund.

An analysis of how the government allocated environmental funds resources showed that they spent only 53.2%. At the end of 1991, 0.4 billion rubles remained in the fund. After policymakers raised prices on Jan. 1, 1992, the funds depreciated more than 10 times.

Why did the government leave such a large sum unspent? The explanation may lie in the importance of regions having the institutional structure for managing environmental protection. As a rule, the regions that participated in the experiment from 1989 to 1990 were better prepared to introduce pollution fees. The only exception was Moscow. The 47% of funds it spent was lower than in other participating cities. The reason lies in the conflicts between legislative and executive authorities who could not agree on how and where to spend the money.

A major problem that surfaced during the experiment as well as afterwards was collecting payments from polluting enterprises. Because there was no legal basis for collecting pollution fees, paying them was voluntary. As a result, many enterprises simply refused to pay. The government sued them with little success. In Moscow, of the 95 cases that went to court or arbitration, only 16 were resolved in favor of Moscompriroda (the Moscow Environmental Committee). The enterprises that refused to pay were often large, monopolistic factories that had political and economic power in both local and federal governments. For example, in 1990, the auto manufacturer ZIL did not pay the 10 million rubles it owed the environmental fund. In 1991, electric power stations in Moscow (Mosenergo plants) also refused to pay. According to estimates, if the government had collected fees and satisfied all actions, the environmental fund would have collected about 200 million rubles in Moscow alone. The Environmental Protection Act of 1992 took into account all these aspects.

The 1992 Environmental Protection Act: Developing a Fee System

The 1992 Environmental Protection Act legalized the system of pollution fees that had been in operation since 1989. Chapter III, Article 20 of the Act established fees for allowed and above-limit emissions. The Act stressed polluters' unquestionable obligation to pay the fees, thereby eliminating any basis for contesting them. Furthermore, the Act required all polluters to have licenses. The licensee had to sign an agreement that fixed fees for allowed and above-limit pollution. Such an agreement had as much judicial force as any other document and was the basis for fulfilling Article 20. The Russian government settled payment rates, but executive authorities could change them. On Aug. 28, 1992, the government adopted a procedure for calculating fees and a marginal level for pollution and other harmful influences (Russian Council of Ministers 1992).

The Act also increased the 1991 fees fivefold and expanded the possibilities for regional differences. Regional authorities, with the federal government's help, defined regional differences. They planned to introduce a new payment system with regional differences in 1993. They were to add fees for other types of harmful activities such as noise, vibrations, electromagnetic fields, or radiation.

The Act established a system whereby environmental funds would be outside the general budget (analogous to the Social Security Trust Fund in the United States). The system has three levels. The highest is the federal fund. The medium level is the regional (republican) fund. The lowest level is the local (municipal) fund. According to the Act, 10% of pollution fees go to the general federal fund and the remaining 90% go to maintain environmental authorities. Of this latter allocation, 60% went to the local fund, 30% to the regional fund, and 10% to the federal fund. This fixed, legalized procedure regulates the allocation of pollution fees collected.

Other Economic Incentives

The Taxation Act (Russian Supreme Soviet 1991) exempted up to 30% of "profits" allocated for environmental purposes from the profit tax. The Environmental Protection Act outlined broader tax privileges. But these privileges can be used together only if there are corresponding changes in other laws, which are unlikely. The Russian Finance Ministry opposes such changes fearing they would further worsen Russian budget deficits.

It would be interesting to follow incentives arising from existing tax preferences, but such data are unavailable. However, Golub's unpublished analyses suggest that the current system of taxation, fees, and preferences do not create enough incentive for businesses to allocate resources to the environment. If all environmental investments were tax-exempt and free from value-added taxes, the pollution fee should be no less than 48% of the necessary abatement costs. Otherwise, the fee should be substantially higher.

Analysis of the Pollution Fee System's First Results

Our study's main purpose was to compare the effectiveness of the pollution fee system and the command-and-control system of environmental management. Because the system was new, we wanted to identify the direction of fee development and enforcement. Furthermore, we conducted our study during an economic crisis and had to eliminate those influences.

As a result, we based our analysis on case studies. To understand the effectiveness of the pollution fee system, we analyzed the dynamics of investments in environmental protection. Investments were cut three times in 1992 compared with 1990. But according to expert estimations, the average investment reduction from 1990 to 1992 was twofold (Shatalin 1994). The economic crisis can only partially explain this reduction. Further curtailment means that new investment sources did not reach the 1990 levels. Why? In Russia, there are now two main sources of environmental investments.[7] They are environmental funds (collected pollution fees) and abatement investments of the polluting enterprises.

Polluting enterprises invest their own resources in abatement equipment if it is more profitable than paying pollution fees. From our analyses, we concluded that, given the existing economic difficulties, pollution fees are not providing sufficient incentives for enterprises to apply their own resources for environmental purposes.

Using data on abatement investments and expected emissions reduction, we compared the volume of air emission fees with the level of investments. Our calculations showed that the amount of investment necessary to reduce emissions was several times higher than the pollution fee for that emission.

For the energy sector and for ferrous metallurgy, we calculated the ratio between the investments needed to reduce emissions by an amount V, I(V), and the amount of fees, *P(V)*, that the enterprise would save if it made the investments *I(V)*. The ratio *I(V)/P(V)* was 4.2 to 11.6 for the energy sector and 3.3 to 12.2 for ferrous metallurgy. The upper and lower limits were defined by the hypothesis about sharing penalties. If we consider almost all fees as penalties, then they do not create effective incentives in these industries. For almost all industries, abatement costs exceeded the level of pollution fees by less than 2.3 to 2.8 times.

From these results, we conclude that pollution fees have not created sufficient incentives to motivate polluting enterprises to invest in abatement. Similar results from a survey of 65 large enterprises in 24 regions confirmed our conclusions (Dumnov 1992). The survey showed that, on average, enterprises spent 0.2% of their total annual receipts on pollution fees. Every fifth enterprise did not pay pollution fees. Though the pollution payments had only a minor effect on profits, 80% of business leaders surveyed said they had increased their production prices to compensate. The pollution fee receipts would have been 70% greater if all fees had actually been paid. None of those surveyed considered environmental investments necessary. Therefore, it is doubtful that this environmental investment source was significant.

The other source of pollution prevention investment was the environmental fund. But, as mentioned earlier, because the pollution fees were seldom collected, they were too low to provide adequate resources. In 1991, the government could not collect pollution payments because of judicial wrangling. In 1992, it could not collect them because most enterprises were nearly bankrupt. Businesses paid only 33% of 2.7 billion rubles owed the environmental fund in the first two quarters. After large-scale credits from the Russian Central Bank in the summer of 1992, many enterprises managed to cancel their pollution fee debt.

Surprisingly, there have been many positive results from the pollution fee system. First, pollution fees initiated a new environmental management system. Case studies have shown that the pollution fee system provided the impetus for Russia to develop a monitoring system. Second, it caused a sharp increase in the number of enterprises with set Maximum Permissible Concentrations and Temporary Coordinated Levels of emissions. The Moscow and Vologda experiences suggested this result though data were not available for the entire country. Third, the two-tier pollution fee system stimulated many polluting enterprises to sign agreements with the environmental agencies that outlined their strategy for reducing pollution. Without a signed agreement, the agency considered an enterprises' emissions above-limit and subject to much higher penalties. These enterprises also had no fixed Temporary Coordinated Level standards. Thus, assembling all the documents necessary to establish their permissible volume of emissions benefitted those enterprises.

Last, the environmental fund supported by pollution charges promoted the development of a market for environmental services. At first, it was hard to spend money because the market for abatement equipment was limited. In addition, the decision-making procedure for allocating resources was unclear and a source of conflict between executive and legislative authorities.

Our analysis showed that the regions that spent the largest percentage of their resources on abatement were those that had participated in the experiment. Of these, three-fourths spent 80% or more of their own resources in 1991. This fact testifies to the tremendous capacity of environmental authorities and the new environmental management system to adapt quickly to forming market conditions.

Endnotes

1. Fundamental acts are short laws that establish the framework upon which other laws are built.

2. For example, the US National Ambient Air Quality Standards for SO_2 are 0.08 mg/m^3 (primary annual), 0.365 mg/m^3 (primary 24-hour) and 1.3 mg/m^3 (secondary 3-hour) (Tietenberg 1992).

3. Maximum Permissible Concentration was exceeded by a factor of 6 in Donetsk and Osh, 5.3 in Frunze and Rustavi, 4 in Fergana, and 3.4 in Dnepropetrovsk, Odessa, and Makeevka.

4. Maximum Permissible Concentrations were exceeded by a factor of 6.2 in Astrakhan, 4.8 in Kirovakan, 4.4 in Krivoy Rog, 4 in Norilsk and Novotroitsk, 3.8 in Grozny, and 3 in Cheljabinsk, Saratov, Jaroslavl, and Donetsk.

5. State standard N 17.02.3.02 *Environmental Protection. Atmosphere. Rules for Settlement of the Permissible Levels of Harmful Components Concentration in the Emissions of Industrial Enterprises.*

6. The standard model for air pollution is the Ephir model.

7. We did not include credits or bonds because their high interest rates are unbearable for comparatively poor-performing investments.

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