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USAID Mission to Lithuania Technical Assistance on Environmental Issues

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ACRONYMS

CED	Central and Eastern Europe
EAP	Environmental Action Program (EAP) for Europe
ENR/ENI	USAID Environment and Natural Resources Division of the Bureau for Europe and the New Independent States
EPA	Environmental Protection Agency
EPD	Environmental Protection Department (of MEP)
ESP	Electrostatic Precipitator
EXIM BANK	U.S. Export Import Bank
GDP	Gross Domestic Product
FSU	Former Soviet Union
MEP	Ministry of Environmental Protection
NGO	Nongovernmental Organization
NIS	New Independent States
PPC	Project Preparation Committee
PRIDE	Project in Development and the Environment
REPDs	Regional Environmental Protection Departments (of MEP)
TA	Technical Assistance
USAID	U.S. Agency for International Development
WEC	World Environmental Center

EXECUTIVE SUMMARY

According to the U.S. government commitment under the Lucerne Agreement to support the Environmental Action Program (EAP) for Europe, a joint USAID/PRIDE team carried out a project identification mission to Lithuania between 19 September and 7 October 1994. The purpose of the mission was to select a representative sample of promising environmental projects and assess their economic and technical feasibility. The team was also asked to specify additional USAID technical assistance and funding sources that will enable the Lithuanian sponsoring entities to implement these projects.

In the course of its mission, the team met with senior government officials in the ministries of environmental protection, energy, economy, finance, and trade and industry to better understand current environmental priorities and fiscal allocations in each sector. The environmental specialists from the World Bank and EU Phare gave us an overview of their organizations' work and project fundings. These discussions were supplemented with visits to six provincial cities (see map, page v), during which we met with industrial managers and toured potential project sites, including the following:

- An artificial fiber factory in Kaunas
- The facilities of Achema, a chemical company, in Jonava
- The Kedainiai State Chemical Plant in Kedainiai
- Two tanneries and the temporary hazardous waste facilities of Toxica, a hazardous waste management company owned by the city of Šiauliai and a number of industrial concerns in that city
- Akmenes Cementas, a cement company in Naujoji Akemene
- Ventos Statybines Medziagos, a construction materials company in the city of Venta

We identified two promising projects at the cement works of Akmenes Cementas and the chemical plant of Achema. Our recommendations were based on the likelihood that the proposed projects will avoid or reduce environmental health risks and on their economic and technical feasibility. Further, the selected projects belong to industries that are potentially competitive on a domestic and international basis and thus capable, because of their internal strengths, to service the debt that will be required to effect the needed changes.

Akmenes Cementas would like to acquire continuous monitoring equipment to control current plant emissions and reduce future emission levels by optimizing plant operations and processes for producing cement. At present production levels, the company is expected to

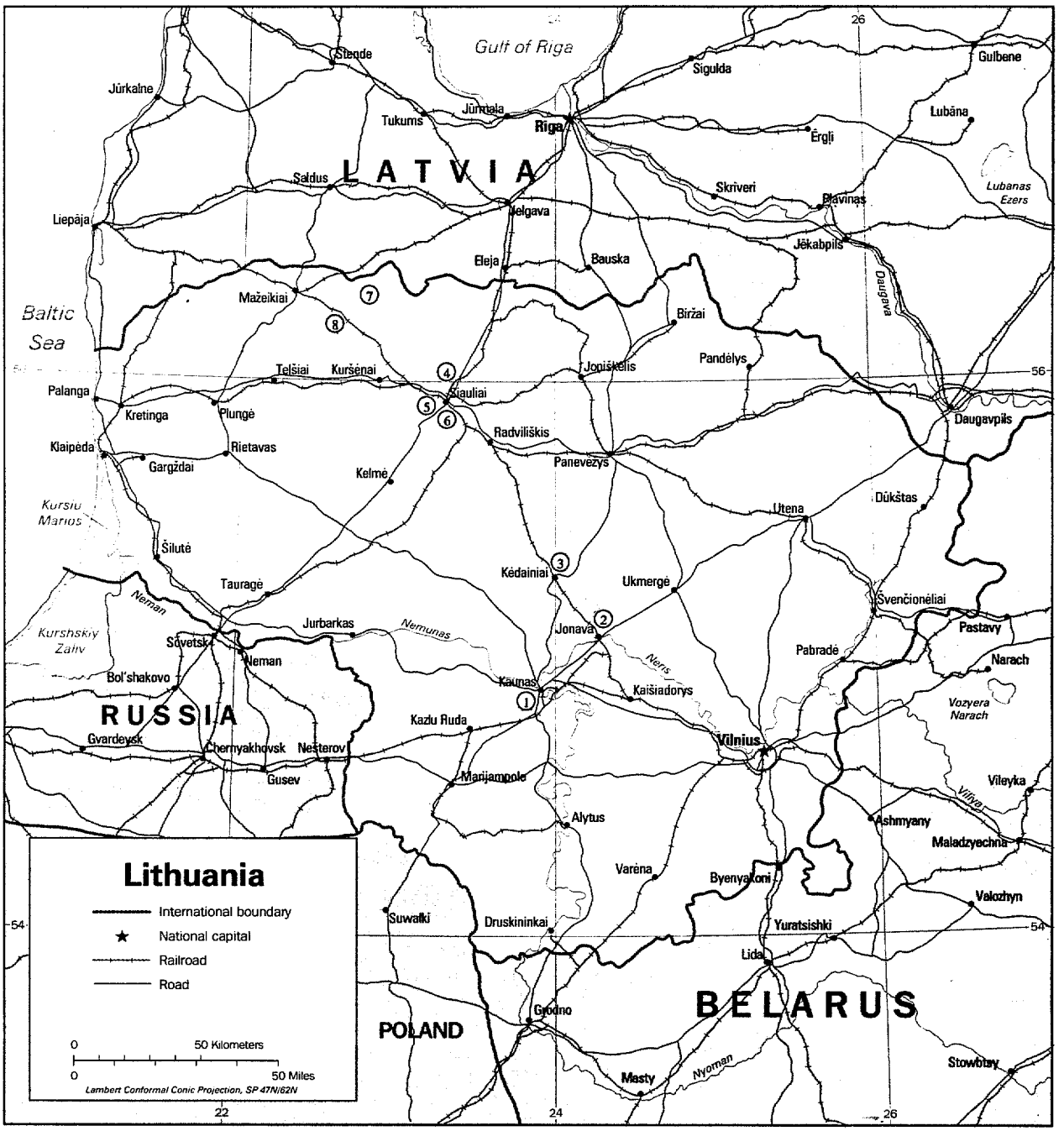
survive the current recession and is poised to expand its production as the economy recovers. Exports are likely to rise in view of the competitiveness of the product in Western Europe, in general, and Scandinavia, in particular. Therefore, we recommend that USAID provide Akmenes Cementas with technical assistance to evaluate equipment needs and secure external funding.

We also recommend providing additional technical assistance to Achema to help it secure financing for U.S. automation equipment. The company's proposed product and process restructuring plan is environmentally sound. The plan will reduce hazardous emissions significantly, and will facilitate the production of a new line of fertilizers in high demand overseas. We expect the proposed refurbishment to strengthen Achema financially and enable it to increase investments to improve plant performance and reduce hazardous emissions in the future.

The team confirmed that the oil refinery at Mažeikiai is a major source of pollution in Lithuania. However, the team believed that the size of the project would be greater than the resources currently available for USAID-EAP work in this country. Moreover, several modifications to the refinery are being contemplated that would significantly change the refinery's operations. Nonetheless, it would be an important project to consider in the future, primarily because it supplies all of the high-sulphur fuel for the country's energy production.

The mission team visited a hazardous waste storage site managed by the Šiauliai municipality and used primarily by two local tanneries. Hazardous waste, primarily water-bearing sludge (minimally treated), is being stored in excavated pits. The municipality and the two tanneries have formed a jointly held company, Toxica, that is to treat the waste and store it in a more secure facility. The municipality and the tanneries are seeking financing for the construction of the hazardous waste facility. However, several issues must be resolved between the municipality and the tanneries that use the facility before a project could be considered. Mr. Mimura from the Government of Japan visited Šiauliai and is considering working on this project.

Regarding the other projects we investigated, we feel that additional TA in waste minimization will produce incremental benefits. However, for the reasons outlined in this report, we do not feel that they qualify right now for further assistance within the Project Preparation Committee framework of the EAP.



(1) Kaunas Synthetic Fiber Plant (Kaunas Dirbtinis Pluoshtas)
(2) Achema (Azotas) Fertilizer Plant
(3) Kėdainiai Fertilizer Plant
(4) Šiauliai Municipal Hazardous Waste Facility
(5) Šiaulių Stumbras Tannery
(6) Elnias Tannery (Šiauliai)
(7) Akmenės Cementas Cement Plant
(8) Ventos Building Materials Plant

SECTION I
OVERVIEW AND RECOMMENDATIONS

A. Overview

This first mission to the Republic of Lithuania in support of the Environmental Action (EAP) for Europe was carried out between 17 September and 9 October 1994. Like its predecessors to Poland, Slovakia, and the Czech Republic, the mission falls within the framework of the project preparation component of the EAP. It was performed pursuant to the U.S. government commitment to identify and support pre-investment technical evaluations and financial feasibility studies of infrastructural and industrial projects aimed at reducing public health risks.

During our three-week mission, we visited six cities in addition to Vilnius and held follow-up meetings with the senior management of two promising projects. We visited the following sites:

- The artificial fiber factory owned by the Kaunas J/S Company in Kaunas
- Achema, a chemical company formerly known as State Enterprise Azotas, in Jonava
- The facilities of Kedainiai State Chemical Plant, a joint-stock company in Kedainiai
- Two tanneries, the municipality, and the temporary facilities of Toxica, a recently formed hazardous waste management company jointly owned by the city of Šiauliai and a number of industrial concerns in that city
- The plants of Akmenes Cementas, a cement company in Naujoji Akemene
- The headquarters of Ventos Statybines Medziagos, a firm specializing in the production of construction materials and other limestone-based derivatives

B. Findings and Recommendations

Generally speaking, environmental conditions in Lithuania do not appear to be as critical as those in other Central and Eastern European countries. This is due in part to the country's decentralized industrial concentration, reliance on nuclear power generation for most electricity needs, and current economic restructuring and steep industrial decline.

Of the six potential projects selected at the start of the mission, only two currently qualify for additional technical assistance within the EAP's Project Preparation Committee framework. However, we believe that the issue of surplus pesticides scattered around Lithuania deserve special attention; therefore, we recommend that future missions to that

country closely study the problem. The summary of our findings is presented below. Review and evaluation of the proposed projects can be found in Section III.

B1. Akmenes Cementas

The management of the Akmenes Cementas manufacturing company plans to add equipment to upgrade several of its kilns. One factor limiting plant modernization is the lack of precise data on the kiln conditions and optimal levels of inputs required for quality product manufacturing (energy, air, limestone, iron oxide, etc.). The plant is currently operating at less than half its capacity. However, it is exploring new markets domestically and in Scandinavia. Due to export markets, production is expected to double this year.

The need for monitoring equipment to control plant emissions is critical, both from the viewpoint of controlling emissions now and reducing future emission levels through optimizing plant operations and processes for producing cement. Accordingly, we strongly recommend that USAID provide technical assistance (TA) in procurement and installation of continuous emission monitoring equipment for the single operational kiln being used for cement production. This TA should include advising plant management on equipment and assisting in financing its purchase from U.S. sources through guarantees from the U.S. Export Import (EXIM) Bank. We expect the cost of required equipment to be from the $300,000 to $400,000.

B2. Achema

The Achema chemical company has recently formulated a more environmentally sound production of its nitrogen-based fertilizers. Specifically, the plant will change production to replace granular products with liquid fertilizer. This is expected to cut ammonium nitrate, ammonia, and urea emission levels by about 850 to 900 tons annually through a reduction in prilling operations and better control/monitoring of reactors and significantly reduce emissions of noxious gases from the plant. Market analysis shows that the production of alternative nitrogen-based fertilizer products will allow the company to penetrate overseas markets, improve productivity, and increase profits.

The proposed plan calls for the procurement of $3 million in equipment, including mixing reactor vessels to prepare liquid chemical formulations from urea and ammonium nitrate streams, and automation and monitoring equipment supplied by Rosemont, for approximately $1.2 million. The automation equipment will accomplish the following: (1) monitor and precisely control the existing reactor for synthesis of ammonium nitrate from nitric acid and ammonia and (2) monitor and control new mixing reactors for producing liquid fertilizer chemicals based on urea and ammonium nitrate.

We believe that EXIM Bank guarantees for loans needed to finance the Rosemont equipment would greatly increase the likelihood of Achema's procurement. The company needs assistance, however, in qualifying for the loans. USAID should provide the services of a business planner, a financial consultant, and a chemical engineer to review the company's operations, help it refine its business plan, determine the equipment specifications, and assist in the procurement and financing of necessary equipment.

B3. Kaunas Artificial Fiber

The management of the Kaunas Artificial Fiber plant would seek assistance to reduce acetone losses in order to comply with ambient air standards imposed by the government. In 1991, these losses amounted to 360 kg/ton of yarn produced, a total of 1,080 tons based on annual yarn production. Losses in acetone are accompanied by energy losses, since warm air is used to vaporize acetone from the yarn filaments and replenish the factory floor air to maintain exposure standards in the work place. However, neither these emissions nor other emissions pose a significant health or environmental risk at this point. The present exposure standards, inherited from the former Soviet Union, are too strict (even by Western standards) and impose significant economic hardships for the fiber plant. The energy costs in the manufacturing process are about 15 to 20 percent of total production costs. Energy costs may be reduced by almost half when reasonable exposure standards are applied. The environmental conditions in and around the plant are not critical.

We see no need for follow-up technical assistance within the PPC framework. However, USAID may consider extending the technical assistance in waste minimization currently provided by the World Environmental Center (WEC). This program, which will soon end, has yielded some important environmental and economic results for the enterprise.

B4. Kedainiai Chemical Plant

The air quality within the Kedainiai Chemical plant and around Kedainiai is within ambient air quality standards observed in Lithuania; plant operations do not pose a risk to the environment. We see no need for technical assistance within the PPC framework. However, incremental gains are still possible. Management has expressed a desire for additional assistance from WEC to help improve fuel oil burner performance for the boiler plant. Successfully developing evolving solutions for burner-related problems may result in reduction of soot and NO_x emission levels. Controlling air to fuel ratios may also improve the fuel efficiency for raising steam and thereby peripherally decrease SO_2 emissions into the atmosphere by reducing fuel needs.

B5. Šiauliai Hazardous Waste

The current situation at the Šiauliai hazardous waste storage site, while not posing an immediate health threat,[1] appears to be environmentally unsound and dangerous to the local population. Water-bearing sludge waste containing significant amounts of chromium from tannery operations is stored in open pits excavated as needs arise. Local environmental officials told the team that the pits were located above a natural horizon of clay sufficient to keep the waste from leaching into groundwater sources. Nonetheless, it appeared to the team that waste could overflow from the pits onto unprotected soil, given the high rainfall in the area and general lack of evaporation.

[1]Emissions of airborne carcinogenic substances are suspected to be high in Siauliai. However, no morbidity statistics or specific studies have been instituted to relate these emissions to local health issues.

The project proposed by the city and the newly formed waste management company, Toxica, has definite merits. However, we were not convinced that the sponsoring entities have the capability to recover capital and recurrent costs.

At our suggestion, S. Mimura of the Japan Special Fund will further investigate the proposed project with Toxica and the city's department of environmental protection to determine whether the feasibility study can be financed from that fund.

B6. Ventos Statybines Medziagos

Major investments may be needed to suppress emissions from the facilities of the Ventos Statybines Medziagos construction materials company. The company has problems with dust, SO_2, and NO_x emissions. However, we are not convinced that improvements will contribute to sustaining profitable operations. The production of lime is down to about 30 percent of capacity, and only one kiln out of four is in operation. The limestone milling operations are down to 12 percent of capacity, because there are so few markets for this product.

Before recommending major TA efforts within the framework of the PPC, a thorough assessment is needed of the physical condition of the plant facilities and engineering processes. The viability of the enterprise and the market prospects of the company must also be determined before any investment decisions are made. Accordingly, if assistance to WEC's waste minimization program is made available, we propose limiting future TA.

SECTION II
MISSION OBJECTIVES AND PROJECT SELECTION CRITERIA

Our team's mission to Lithuania follows up the preliminary groundwork performed by Melody Bacha during her visit to Lithuania in August 1994. Ms. Bacha, of USAID's Environment and Natural Resources Division in the Bureau of Europe and the New Independent States (ENR/ENI), had met several government officials in the environmental, economic, and financial sectors, as well as industry managers and representatives from various multilateral development institutions. The purpose of her visit was to (1) coordinate the activities of ENR/ENI with the Office of the USAID Representative in Vilnius, (2) assess local resources and expertise and the possibility of their mobilization to achieve the EAP objectives, and (3) refine the scope of work of this mission.

Ms. Bacha also visited a project site in Kaunas, where the WEC is assisting Inkaras—a joint stock company that produces rubber tubing, shoes, and a growing line of medical supplies—in a waste minimization project.

A. Mission Objectives and Terms of Reference

The present mission, composed of two USAID environmental investment advisors and three consultants from the Project in Development and the Environment (PRIDE), had two principal objectives: (1) identifying, selecting, and evaluating economically viable environmental projects that are potentially "bankable" and could benefit from additional USAID assistance and (2) assessing domestic and international financing options available for the identified projects. The team was to obtain the commitment of TA recipient entities and government agencies to complement future USAID assistance with local expertise and other resources.

Our terms of reference also included the following:

- Explaining the PPC investment criteria and USAID technical assistance available for project preparation.
- Obtaining a clear understanding of current environmental and economic conditions, the institutional setting governing the environmental sector, and public investments in that area.
- Recommending, as appropriate, procedures for enhancing coordination among various government agencies (at the central and local levels), industry federations, and other non-governmental organizations (NGOs) in the areas of data collection and analysis of ambient environmental quality conditions, environmental health risks, and project identification, prioritization, and selection.

B. Project Identification Criteria

B1. Screening Methodology

Our team developed the project screening criteria on the basis of input received from government agencies, particularly the Ministry of Environmental Protection, the Public Investment Program Unit, and the Investment Department at the Ministry of the Economy. This information provided us with an overview of the government's environmental policy directions (i.e., that Lithuania is in the process of developing its environmental policy) and its capital investment priorities in the water, wastewater, and solid waste management areas.

Our team also sought the input of the Secondary Raw Material and Waste Division at the Ministry of Industry and Trade and the Lithuanian Environmental Engineering Association, a trade group that represents the interests of the Confederation of Lithuanian Industrialists. From these meetings, we learned about current industrial conditions and restructuring efforts, government investment priorities in various industrial sub-sectors, the economic health of recently privatized industrial concerns, and their ability to finance plant rehabilitations, new production lines, and pollution abatement investments.

This EAP mission had the benefit of using reports on waste minimization for half a dozen industrial plants. The reports were completed by the World Environmental Center (WEC) under the auspices of USAID and were valuable sources of information on environmental problems of each plant.

One significant problem that the team encountered in its project identification objective was the lack of data on pollution and health statistics. Attempts to collect air emission baseline information from the Energy Agency and the Atmosphere Protection Unit (Ministry of Environmental Protection) were frustrated by the lack of recent and reliable data on emissions in the various regions of the country. The general economic slowdown, which is causing numerous plants to operate at reduced capacity, has exacerbated the lack of researchable data. Similarly, no statistics on morbidity and environmental health risks were available at the National Center for Hygiene of the Ministry of Health.

Our meetings with representatives from the World Bank, EU Phare, and the Ministry of Finance provided us with a general overview of current and proposed environmental projects for which funding has been already earmarked.

B2. Site Selection Criteria

Pursuant to the terms of the Lucerne Agreement, we accorded the highest priority to projects that:

- Offered the greatest potential for reducing environmental health risk.
- Had a significant impact on local conditions and could serve as demonstration projects replicable at the national and regional levels.
- Could be implemented in a relatively short period of time at a relatively low cost.

The Environmental Action Program

The EAP for Central and Eastern Europe (CEE) was formulated at the meeting of ministers of the environment from Western countries and former Soviet Bloc nations in Lucerne, Switzerland in April 1993. The EAP recognized that, despite extensive efforts in the CEE and the New Independent States (NIS) of the former Soviet Union, severe environmental problems remain unresolved. In view of the limitation of grant financing for environmental investments, it was decided that Western aid and resources should be focused and leveraged with those of the recipient governments to maximize their impact. The EAP specifically cites the following pollutants as critical:

- Airborne dust
- Lead and heavy metal in air and soil
- Sulfur dioxide (SO_2), nitrogen oxides (No_x), carbon monoxides (CO), and other gases, especially in combination with dust

However, the Lucerne Agreement also recognizes that specific regions and localities may have equally serious environmental health threats in addition to these region-wide hazards.

EAP Structure. Two task forces were established to support EAP efforts. The first group includes the signatory countries, international financial institutions (IFIs), and environmental NGOs and was to be responsible for assisting CEE and NIS countries in the formulation and development of national environmental action programs. The second group, known as the Project Preparation Committee (PPC), was to coordinate donors efforts in identifying, selecting, and preparing projects for possible funding through IFIs. Four environmental investment advisors were provided by individual PPC members to the World Bank and the European Bank for Reconstruction and Development.

PPC Criteria. The funding of EAP projects is expected to be obtained from domestic and international markets, including IFI loan facilities. Therefore, the projects selected by the host countries and the PPC must be economically viable and credit-worthy to access the debt markets. To support the PPC process, the U.S. government pledged $10 million over a three-year period. Most of this assistance was to be channeled through USAID, although EPA is also an active participant in the two task forces.

USAID Missions. To stimulate host country efforts in setting up domestic processes in the development of national EAPs and PPC activities, USAID fields periodic missions to the region to (1) explain PPC criteria and provide technical assistance in project preparation, (2) identify and evaluate projects that fit the PPC criteria *in terms of environmental health improvement and economic viability,* and (3) determine the commitment of the local sponsoring entity and ascertain how future technical assistance can be best used.

Because of the clear impact of air pollution on human health, we focused almost exclusively on projects aimed at lowering emissions. Projects aimed at addressing water and soil contamination were reviewed but not pursued due to lack of material evidence on health risk.[1]

[1] Projects aimed at reducing the surface, groundwater, and soil contamination that results from industrial practices were also screened. Specifically, a hazardous waste facility and two tanneries in Šiauliai were evaluated as a possible EAP project. After visiting the city and its proposed hazardous waste treatment facility, the team concluded that the current method of treating and storing the hazardous wastes from the tanneries was dangerous and environmentally unsound. However, we also concluded that the proposed project could be not be managed outside the framework of a regional plan for disposing of hazardous waste materials. At our suggestion, Mr. S. Mimura of the Japan Special Fund subsequently visited Šiauliai with a member of our team to assess the possibility of funding a feasibility study for that purpose.

In addition to the criteria noted above, our team employed the same financial and management yardsticks used in screening PPC investment projects during previous missions to CEE countries. These criteria tend to favor projects offering the most promise in terms of economic viability, emphasizing the financial stability and capacity to service debt used in project implementation. Also important are:

- Demonstrated ability or potential of the sponsoring entity to eventually recover the initial capital investment costs and the recurrent operation and maintenance expenditures.

- Financial strength of industrial concerns and fiscal outlook of local government units seeking financing for their environmental projects, industry stability, and prospects for market expansion.

- Willingness and ability of the management of the recipient entities to properly operate and maintain existing and new environmental facilities and to modify processes and practices as needed to comply with national environmental and health standards.

- Willingness of the management of the recipient entities to cooperate in all phases of project feasibility, including disclosure of their financial position to potential creditors or guaranteeing agencies when necessary.

Our project screening and prioritization process differed from the priorities of the Lithuanian government in relation to water and sanitation projects. The Ministries of the Economy and Environmental Protection have put previously uncompleted wastewater management and water projects (those from the Soviet era) on the top of the list of urgent capital investments in the coming fiscal year. This is unquestionably the correct course, particularly when capital is rationed due to continuing decline in government receipts. It also makes a great deal of sense to complete ongoing infrastructure before starting the construction of new facilities. Our difference with these priorities, however, stemmed from the fact that, despite their definite merits, these projects do not conform to the PPC criteria in two respects. They have no direct impact on health hazard reduction. Furthermore, the local government units in Lithuania, which have ultimate responsibility for operating and maintaining these facilities, have no adequate tariff structure and user fee mechanisms to recover capital investment and recurrent costs.

B3. Project Selection

Unlike the previous missions to Poland and the Czech Republic, the main focus of this mission was on industrial plants in two industrial triangles:

- The northwest triangle of Mažeikiai-Akemene-Venta, where Lithuania's only oil refinery, a 3.4 million metric ton capacity cement plant, and a major construction material plant are located, along with two large tanneries and a number of electronic firms in the nearby city of Šiauliai.

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- The central triangle of Kedainiai-Jonava-Kaunas, where Lithuania's two largest chemical plants are located.

Our final project choice was influenced by previous work performed by WEC, as well as the government's priority economic sectors, including cement and construction materials, chemicals and fertilizers, wood products and furniture, electronic measurement and control equipment, pharmaceuticals, equipment for disabled persons, and leather industry (mainly tanning).[2]

It should be noted that government ministries, nongovernment organizations, and donors agreed that the oil refinery at Mažeikiai posed a significant source of pollution. Not only is the plant a source of substantial hazardous air emissions, but it also employs outdated refining processes that do not remove adequate amounts of sulphur from high-sulphur Russian crude feedstocks. Thus, this plant contributes in a larger sense to the overall air pollution in Lithuania, since it provides sulphur-laden heavy fuel oil for heating/power plants and gasoline.

While the Mažeikiai plant would apparently fit the EAP criteria, the team concluded that the resources currently dedicated by USAID to EAP projects in Lithuania would be insufficient to do any significant work at the refinery.

Environmental Investment Priorities

According to Arunas Kundrotas, Secretary of the Ministry of Environmental Protection, wastewater management projects are the highest priority of the Lithuanian government, followed by hazardous waste management projects, including cleanup of contaminated former Soviet military bases and facilities. The secretary believes that air pollution is not a very serious problem in view of the general economic slowdown and that it does not constitute a major health risk at the present time.

Rimantas Zabarauskas, head of the Public Investment Program Unit at the Ministry of the Economy, explained to us that fiscal allocations for environmental projects are prioritized as follows: (1) cabinet decision, (2) completion or rehabilitation of existing facilities, (3) costs and proposed tariffs, and (4) availability of foreign funding sources.

During FY 1994, the government allocated Lt150 million ($37.5 million) to municipal environmental infrastructure. Plans for equal capital investment allocations in FY 1995 were constrained by a 40 percent shortfall of anticipated government receipts during 1994 and IMF-imposed restrictions. As a result, the Ministry of Finance instructed the Public Investment Program Unit to trim its plan to Lt100 million. The initial capital investment budget called for funding 30 to 35 wastewater management projects and one hazardous waste facility proposed by municipal and regional governments.

[2] Since Lithuania relies on nuclear generation for nearly 90 percent of its electrical needs, power generation did not appear to be a major problem at the present time. Similarly, district heating plants, which operate on both fuel oil no. 5 and natural gas during the winter season, did not appear to pose a major problem. Indeed, the plants operate mostly on natural gas, the topography is relatively flat, and prevailing wind conditions allow for adequate dispersion of air emissions.

SECTION III
CURRENT ENVIRONMENTAL AND ECONOMIC CONDITIONS

Pollution and environmental health conditions in Lithuania are less severe than those prevailing in other CEE regions such as Upper Silesia in Poland or Northern Bohemia and Moravia in the Czech Republic. This is due in part to decentralized industrial concentration in Lithuania, reliance on nuclear power generation for about 90 percent of the country's electricity demand, and the severe economic decline that led to reduced industrial production and the closing of some operations. The predominant environmental problems in Lithuania tend to be concentrated in large urban areas, close to industrial plants and, to a lesser extent, near power generation and district heating plants. The major contributor to air pollution in urban areas is the transportation sector, which accounts for close to 60 percent of hazardous emissions.[1]

Water pollution is significant in the Nemunas River and the Courland Lagoon in southwest Lithuania, which is between the coast and the Courland dunes. Intensive livestock farming and widespread use of fertilizers and pesticides, combined with municipal and stormwater discharges, have contributed to surface and groundwater pollution. This has forced municipalities to use deep groundwater as a source of drinking water supplies.

Hazardous wastes resulting from electro-plating, lubrication fluids, and other industrial operations in major cities such Vilnius, Kaunas, and Šiauliai are issues of general environmental concern in Lithuania. Wastes in former military bases and thousands of tons of useless and often unidentifiable pesticides are also of concern.

Aside from the central government budget, there are no sources of domestic capital to fund environmental infrastructure in Lithuania. Local government receipts are meager and invariably insufficient to cover recurrent operation and maintenance costs of environmental infrastructure. Long-term capital is practically non-existent. As discussed below, the Lithuanian economy is weak and short-term interest rates are prohibitively high, making debt service too onerous for municipal and county governments. For this reason, industrial concerns are reluctant to borrow money from the commercial banking sector for anything but working capital and trade finance. Assuming local entities qualify, the PPC investment offers a mechanism for channeling external long-term credits to capital-starved entities in the private industrial and municipal sectors.

[1] The *1993 Environmental Almanac* estimates that one quarter of the industrial workforce is exposed to gas, dust, and toxic substances at levels above safety limits. However, no government statistics were available on environmental and occupational health risks.

A. Environmental Status

A1. Ambient Air Quality

During 1989-1991, at the peak of economic activity in Lithuania, emission of pollutants into the atmosphere from stationary and non-stationary sources totalled about one million metric tons per year. Emission levels decreased markedly in 1992, following the sharp economic downturn that cut the gross domestic product (GDP) in 1993-1994 nearly in half. This decline is continuing, forcing a large number of industrial facilities that previously catered to the USSR and Comecon markets to close down or curtail production to less than 50 percent of their capacity.

Facts about Lithuania

Located on the eastern shore of the Baltic Sea, Lithuania is bordered on the north by Latvia, on the east by Belarus, and on the southwest by Poland and the Russian enclave of Kaliningrad. Most of the Baltic shoreline is separated from the open sea by a long narrow strip of sand dunes called the Courland Spit; the body of water behind the spit is the Courland Lagoon.

The country has an area of about 25,165 square miles (65,200 km sq.) and an estimated population of 3.7 million. About 68 percent of the population live in urban areas. In contrast to most other republics of the former USSR, Lithuania is not dominated by a single urban center.

Lithuania consists of a low-lying plain broken by low hills in the west and south. Almost the entire territory of the country is less than 656 feet (about 200 meters) in elevation. It is dotted with lakes and rivers. The most extensive river is the Nemunas, a major river that supplies the country with hydroelectric power. Marshes and swamps are prevalent, especially in the north and west, although half of all original wetlands have been drained. Forests, which occupy about one-fourth of total land area, support an extensive array of wildlife, including deer, wolves, foxes, and wild boar. The country is poor in natural resources. Minor oil and gas deposits have been found near the coast, and offshore areas may contain larger deposits.

The climate is generally dominated by marine influences. Lithuania has a moderate climate, with cool summers and mild winters. Precipitation ranges from 22 to 34 inches (559-864 mm) a year.

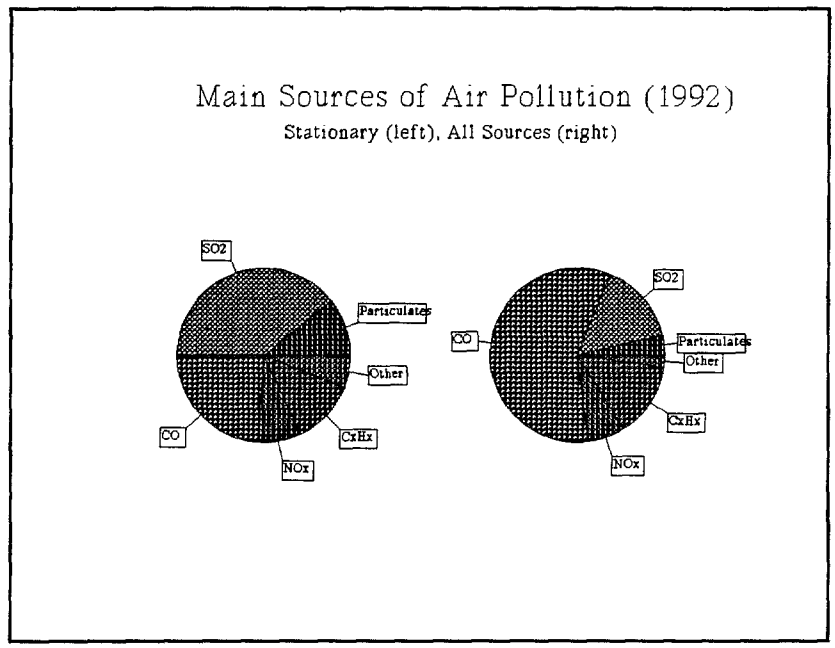
A1a. Current Conditions

Generally speaking, Lithuania does not currently have severe SO_2 pollution or health risk problems. Existing problems can be minimized by using better quality fuel oil supplies or by upgrading/ rehabilitating the Mažeikiai oil refinery to produce fuel with a low sulfur content. The most significant source of air pollution in Lithuania is transportation, which contributes approximately 60 percent of total emissions. Industrial plants and energy facilities are responsible for about 18 percent each. The balance is produced by other sources.[2]

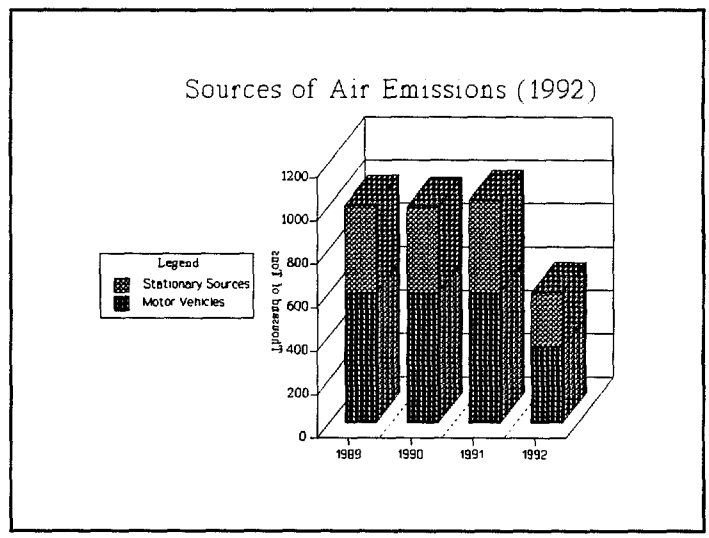
Other common air pollutants in Lithuania are dust, nitrogen oxides, benzo(a)pyrenes (B(a)P) that are known carcinogens, and carbon monoxide. Other species, usually confined to industrial regions, include formaldehyde, ammonia, hydrogen fluoride, fertilizer-based intermediates and chemicals, and industrial solvents.

[2] Traffic accounts for about 80 percent of CO emissions, 60 percent of hydrocarbons, and more than 40 percent of NO_x emissions. Since 1992, tetraethyl lead has not been used to boost gasoline octane rating. The main reason for high vehicle emissions is poor vehicle maintenance and the relatively large number of old cars in Lithuania. Although vehicle inspection is required every two years, the requirement is seldom enforced. There is also a serious shortage of vehicle emission measuring equipment in the country.

Aggregate air quality data suggest that pollution problems are relatively acute in the following: (1) major urban areas (Šiauliai, Kaunas, Klaipeda, and Vilnius), due to a combination of industrial production and relatively heavy traffic patterns, and (2) industrial centers in northwestern and central Lithuania such as Jonava (fertilizers), Kedainiai (biochemicals and fertilizers), Mažeikiai (petroleum refining), and Naujoji Akmene (cement).



For instance, in the Kaunas industrial region, average dust concentration near the power station amounts to 220 to 300 micrograms per cubic meter, nearly double the European Union standard of 150 ug/m3. In Šiauliai, high concentrations of benzo(a)pyrene and dust have been detected. Further north, the petroleum refinery at Mažeikiai and the cement plant at Naujoji Akmene near the Latvian border are significant sources of pollution. The oil refinery emits about 62,000 of pollutants annually, including carbon monoxide, nitrogen oxides, phenols, ksylol, and acetone. The refinery's design is antiquated and its process treatment and pollution abatement equipment are inadequate.

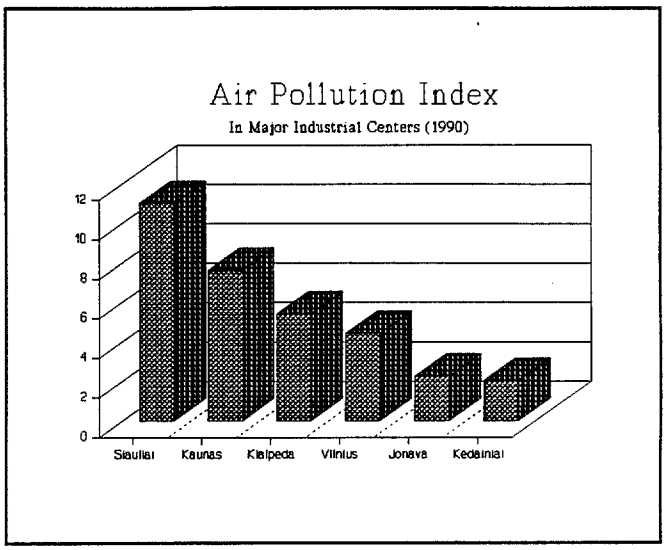


Power plants, district heating systems, and other boiler facilities contribute more than one third of all emissions from stationary sources. In 1990, SO_2 from these sources was about 52 percent of total SO_2 emissions in Lithuania, while the NO_x emissions from these sources contributed approximately 55 percent.[3] The Ministry of Energy states that low-stack district heating plants in urban areas have the capability of using both fuel oil and natural gas, and that for both economic and environmental

[3] SO_2 emissions are attributed primarily to the high sulfur content (2-3.5 percent) of Russian petroleum and the poor condition of the oil refinery at Mažeikiai.

reasons, the government operates them on the less polluting natural gas.

A1b. Health Effects



Reliable morbidity statistics in Lithuania are scarce, not centralized, and generally out of date. Anecdotal accounts and previous studies suggest significant impact on health in a number of localities in proximity to stationary and non-stationary emissions sites.[4] The studies include the following:

- Polyclinic record studies by the Hygiene Center of Kaunas indicate higher rates of acute respiratory diseases among children and adults in the Kaunas industrial region than among similar populations in suburban and rural areas.

- Studies of adults and children in the Savanoriu area of Vilnius conducted by the Research Institute of Hygiene and the Hygiene Center of Vilnius suggest correlation between air pollution and respiratory problems.

- A report by the Research Institute of Hygiene shows increased respiratory disease rates near Elektrenai thermal power plant in central Lithuania.

- A study by the Institute of Oncology identifies Kedainiai, where major chemical industries are located, as the region with the highest rate of lung cancer during the 1970s and 1980s.

In the 1980s, an application for expanding the Azotas fertilizer plant in nearby Jonava was rejected by the Republican Center of Hygiene on the basis of evidence of increased respiratory morbidity among local children. More recently, health data from hospitals and clinics in Akemene have suggested significantly higher incidence of respiratory and throat ailments in that region than in other regions in Lithuania. In nearby Šiauliai, emissions of airborne carcinogenic substances are also suspected to be high, even though no specific studies have been instituted to relate these emissions to local health effects.

A2. Water Quality

The Government of Lithuania considers water pollution as one of the country's most serious problems. Biochemically oxidating and biogenic chemical species are the primary

[4] Cited in *Lithuania: The Transition to a Market Economy,* World Bank Country Study, 1993, pp. 263-264.

pollutants of surface waters. Traces of heavy metals, oil products, and phenols are also found.

A2a. Current Conditions

Most major cities in Lithuania discharge their wastewater into the Nemunas River and its tributaries. The city of Klaipeda, located on the coast, discharges directly into the Courland (Kurso) Lagoon, and the industrial city of Šiauliai discharges its partially treated sewerage into the Gulf of Riga via the Kulpe River. The Nemunas River basin also receives major discharges from urban areas in Belarus and the large pulp and paper mills located in the Kaliningrad Oblast of the Russian Republic.

Of the 345 million cubic meters of wastewater discharged into the surface bodies of water in 1992, only 81 percent of the volume was treated, and only 26 percent of the amount treated met national quality standards. Despite the decrease in the total amount of pollutants in 1993 following the economic downturn, the reduction amounted to only 12 percent of the levels two years earlier.

As a result of the discharges carried by the Nemunas River, the Courland Lagoon has lost most of its capacity to retain and degrade incoming pollutants. It suffers from serious eutrophication and significant levels of algae blooms and contains high levels of other contaminants such as heavy metals. The high pollution levels have resulted in frequent large-scale fish kills and damage to fish habitat, as well as serious decline in fish catches. Beaches at Klaipeda and Palanga have been routinely closed during the tourist season as a result of the pollution problems. These problems have also negatively impacted water quality and marine life in the Baltic Sea.

Agriculture contributes to significant levels of nutrient loads to the Nemunas River basin and to groundwater contamination. This is due to the intensive use of chemical and natural fertilizers, as well as wastes generated from livestock, poultry, pig-breeding, farming, and dairy operations. The problem of agriculture run-offs has been compounded by poor fertilizer application and tillage practices, which fail to distribute the fertilizers deep into the soil. Recently, however, the use of fertilizers and pesticides has declined because of the tenfold rise in the price of fertilizers and the sixfold increase in the price of pesticides.

Leaching from contaminated municipal and industrial waste disposal sites has further exacerbated water supply problems in some areas. This has led municipalities to seek potable water sources from deeper groundwater supplies. However, in rural areas, where more than 75 percent of shallow groundwater wells supply over one million Lithuanians, groundwater exceeds the established limits for bacteriological and nutrient contamination.[5]

[5] Sludge management practices present serious risks for groundwater contamination as well, due to lack of dewatering technology. Recycling and reuse are constrained by high concentrations of heavy metals. Most sludge is dried in land-extensive facilities, which are not lined or monitored and are subsequently disposed of in landfills and other sites.

A2b. Health Effects of Water Pollution

Nearly 3,000 cases of salmonella, shigella, and hepatitis A are reported in Lithuania each year. The authorities attribute them to poor conditions in food processing plants and, to a lesser extent, to waterborne sources. The frequent and timely beach closures and the reliance on deep groundwater supplies have played an important role in preventing outbreaks of diarrheal and dysenteric diseases.

A3. Hazardous and Municipal Waste Management

Under the former Soviet regime (which on paper had rigorous standards for waste disposal), hazardous industrial refuse was mixed with industrial wastewaters and discharged into rivers or commingled with domestic solid wastes and deposited in poorly designed landfills. Present Lithuanian law, however, forbids off-site disposal of hazardous materials and mandates temporary storage of hazardous refuse until safe storage and treatment facilities become available.[6]

A3a. Current Conditions

Of the approximately 200,000 tons of hazardous waste produced annually in Lithuania, only a small portion are disposed of in an environmentally safe manner. The wastes are usually stored at production and disposal sites where they are seldom tracked or accounted for. Recycling and reuse of hazardous waste is limited.

Five million cubic meters of domestic wastes are disposed of in about 300 landfills. Except for major urban landfills, most of the sites have no monitoring programs. Seepage and rainwater runoffs are suspected to constitute an important source of surface and groundwater contamination.

As is the case in most former Warsaw Pact countries, military waste constitutes another major environmental problem. Only 10 percent of 386 square miles of former military base land were inspected; much of them are seriously contaminated. The European Union and Denmark have agreed to help Lithuania in the cleanup of military wastes and contamination left behind by the Soviet Army.

A3b. The Pesticide Problem

Before Lithuania regained independence, pesticide supply to collective farms often significantly exceeded needs. This led to large quantities of often unclassified or unlabelled products stored in approximately 1,200 sites all over the country. Following privatization, large quantities remained unclaimed in inadequate storage facilities. The health risks from

[6] Blukon Miljoe and Chemcontrol A/S, a Danish consulting firm, conducted a feasibility study for a hazardous waste treatment system for Lithuania in 1992-1993 under the auspices of the Investment Fund for Central and Eastern Europe of the Danish Ministry of Environmental Protection. The study estimates that such a system will cost approximately ECU 94.3 million in capital investments and approximately ECU 1.5 million for railroad cars to carry the wastes to central facilities. The same study suggests that the use of existing cement kilns for co-firing hazardous waste can cut capital requirements by almost a half.

such conditions cannot be over-emphasized, particularly when no government or private entity accepts to adopt that cause.[7]

A4. Institutional Framework

Responsibility for environmental policy and enforcement in Lithuania is vested in the Ministry of Environmental Protection (MEP), which was established last spring. Reorganization is still underway to resolve issues related to functions and jurisdiction (for instance, hazardous waste management is still under the control of the Ministry of Trade and Industry). The MEP will particularly concentrate on the establishment of new pollution standards and its own procedures for environmental impact assessments, since most of these tend to be inherited from the former Soviet Union. The MEP is working with foreign agencies such as EU Phare, EPA, and USAID to update them to Western standards.

The MEP is mandated by Parliament to:

- Determine emission standards
- Limit natural resource exploitation
- Issue permits relevant to environmental protection
- Control protected areas
- Monitor emissions
- Prepare and/or evaluate environmental assessments
- Restrict and delay activities upon violations of laws
- Appeal to the Parliament if the Government violates environmental laws

Under the previous system, the Environmental Protection Department (EPD) served as an agency of Parliament responsible for overseeing and coordinating governmental environmental activities. The government was responsible for preparing national programs and regulations for environmental protection and use of natural resources, as well as presenting them to the EPD for approval; allocating financial resources for the implementation of national programs; and coordinating national and local level activities related to environmental protection.

Regional and local environmental protection is also being addressed in the reorganization of the MEP. The ministry has eight regional environmental protection departments (REPDs) that are responsible for the local implementation of national policies and initiatives and the supervision of environmental affairs in 44 counties and 11 municipalities in Lithuania. These local government units are responsible for:

- Application of rules and regulations related to environmental protection.
- Planning and implementing environmental protection programs.

[7] In fact, 44 local government units have recently established temporary storage sites for about 730 tons of pesticides. But the quality of the these facilities leaves much to be desired. The danger posed by these pesticides came to the limelight when a 100-ton storage facility in Rikiosis county caught fire in 1993, causing significant adverse health impact for nearby residents. The slag and soil contaminated at the site continue to pose serious threats to the surrounding areas.

- Establishing local environmental protection funds and coordinating their use.
- Supervising natural resources under their jurisdiction.

Subject to approval by the REPDs, local authorities may introduce more stringent environmental regulations than those mandated by the MEP within their jurisdiction. Most counties and municipalities have their own environmental protection departments or environmental engineers who provide expert opinions and evaluations.

B. Economic Conditions

Lithuania is currently in its second year of economic restructuring. Much of the country's transition has been concentrated on redirecting resources from the Soviet economic model to a market-oriented economy. Lithuania's integration into the USSR after World War II resulted in a rapid transformation from a primarily agrarian economy to one concentrated on industry with capacity to support the large market of the former Soviet Union (FSU).

After an initial rebound in 1993, industrial production fell again earlier this year. Lithuania's inflation, though lower than in 1992 and 1993, is the highest among the Baltic republics. Nonetheless, it is expected that the country's gross domestic product (GDP) will experience a modest recovery this year, following a cumulative decrease of 71.5 percent between 1990 and 1993.

B1. Background

During the Soviet era, Lithuania became essentially a value-added manufacturing center, though agricultural production and specialized agro- and high-tech industries constituted an important component of its economy. As a result, the country has a considerable capacity for machinery manufacturing; metal working; textile, leather, and wood processing; fertilizer production; oil refining; and power generation, all of which were primarily developed to support the USSR economy. While rapid industrialization has endowed Lithuania with significant infrastructure and a highly skilled and educated workforce, the most important industries of Soviet Lithuania are not sustainable in today's resource-poor Lithuania. Many of these industries continue to depend on fuel and raw materials supplies from Russia.[8]

B2. Transition

Lithuania is implementing a comprehensive economic reform program in an adverse macroeconomic environment. GDP declined 37 percent in 1992 and is estimated to have fallen 16 percent in 1993. Industrial output, which has traditionally accounted for the

[8] Recent trade data indicate that Lithuania experienced a trade deficit of Lt 901.7 million ($225 million) in the first quarter of 1994. According to the government, exports amounted to Lt 1.6 billion ($416 million), while imports stood at Lt 2.5 billion ($641 million). The former Soviet republics were the country's main trading partners, with Russia accounting for 25.9 percent of exports and 44.8 percent of imports. The government is exploring ways to reduce Lithuania's dependence on Russian fuel supplies. To do so, it is currently negotiating with Fluor Daniel for the design and construction of a new oil terminal at Butinge, new docking facilities, and a pipeline to the oil refinery of Mažeikiai.

majority of the economic output and one-third of employment, fell 1.3 percent in 1991 and 47.3 percent in 1992, causing much of the current economic decline. Output from the agricultural sector, another significant component of the economy, fell 24 percent in 1992 and another 8 percent in 1993.

The composition of the economic output was also significantly altered during the same period. In 1993, industrial production accounted for 41.5 percent of GDP (down from 52.5 percent in 1991). While the share of agriculture remained relatively unchanged, it actually declined in absolute terms, given the overall drop in economic activity in those two years. The share of services almost doubled (in relative terms) to 20 percent of GDP and appears to be growing.

Faced with international competition, several key industries proved to be either antiquated (household electronics, electro-plating) or uncompetitive (construction materials, some chemical products). Many industries either ceased operations or substantially reduced their production levels. Recently, however, a small number of firms have managed to expand traditional exports to new markets and launch completely new product lines (medical supplies, some leather goods).

The Lithuanian Economy

Although agriculture dominated the Lithuanian economy before Soviet annexation in 1940, industry has become the leading sector of the economy, accounting for nearly 40 percent of gross domestic production (GDP) and 30 percent of total employment. Industries include metalworking, oil refining, ship building, machine construction, paper, chemical products, construction materials, and furniture. Other manufactures include cement, textiles, televisions, and paper. Light industry concentrates on textiles and food processing. Lithuania has a large oceangoing fishing fleet.

Agriculture accounts for about 18 percent of employment. Livestock breeding and dairy farming are the dominant agricultural activities. The principal crops are grain, potatoes, sugar beets, and flax. Mineral resources are limited; they include gypsum, peat, and clay.

Lithuania's natural resources include clays and sands that are used to make cement, glass, and ceramics. It also has modest deposits of oil and natural gas, but for most of its energy needs it is dependent on oil and natural gas imports. Current domestic energy production can meet a large proportion of the country's consumptive needs. However, the economy suffers greatly from Russian demands payment for fossil fuel shipments at world prices. The two Chernobyl-style nuclear power reactors at the Ignalina plant can fill roughly half of the country's energy needs. Technical difficulties, however, have forced officials to close the plant briefly on more than one occasion since independence. The oil refinery at Mažeikiai was forced to close down for a period due to lack of oil.

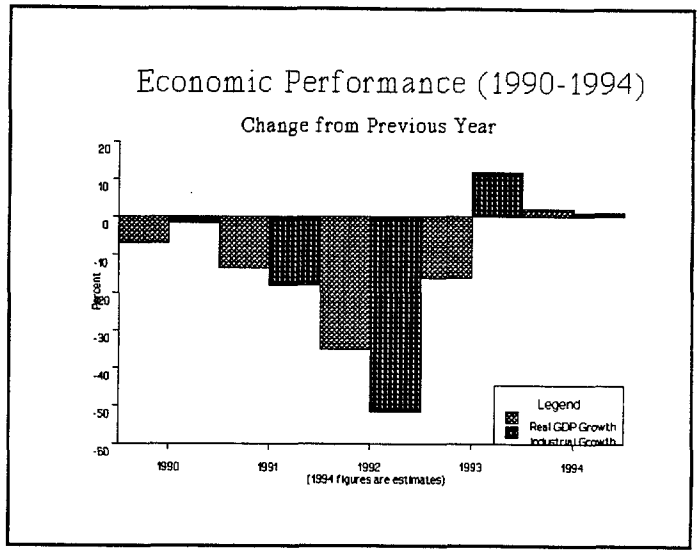
Disruption of economic ties with the former Soviet Union has devastated the economy, leading to a 37 percent GDP drop in 1992. With the energy price shocks and a policy of indexing wages and pensions, inflation became rampant.

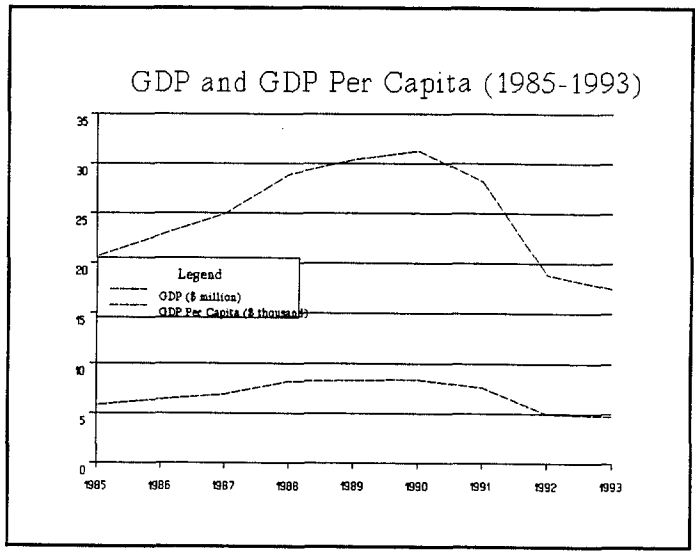
Foreign investments in Lithuania amounted to $101 million last year, compared with $45 million in 1992. The government wants to increase these investments and is presently considering a law to authorize foreign ownership of land, factories, and offices.

B3. Current Conditions

The Lithuanian central bank continues its attempts to maintain a rigorous stabilization program, combining tight incomes and credit policies with fiscal discipline. After an initial

decline that accompanied the economic slowdown and general price increases, some industries (cement and chemicals) appear to be stabilizing. Fiscal discipline also led to small general government financial budget surpluses (one percent of GDP) for three consecutive years. Due to an expansion of public investments and a shortfall of receipts, a small government deficit is expected for 1994.[9] This has led to cuts in planned expenditures on environmental projects in FY 1995 by Lt50 million, which represents one third of the original allocations in the capital investment budget.





GDP is expected to reverse modestly its two-year decline during the second half of 1994, mainly due to expansion of private-sector activity. However, following a $67.5 million deficit the previous year, the trade balance is likely to remain negative. Lithuania's primary trading partners remain the FSU and CEE countries; transit trade with the Kaliningrad Oblast is an important source of revenue to Lithuania, although Russia is slow to pay the charged fees. In the industrial sector, many firms are slowly reorienting their production to the West to diversify their markets, a fact that contributed to the tripling of the volume of trade from 8 percent in 1992 to 24 percent in mid-1993. Nonetheless, in the short term, Lithuania's economic health remains dependent on trade with Russia and on that country's energy resources.

Despite strict control of the central bank, inflation soared immediately after Lithuania regained independence as most prices were liberalized to free-market levels. In 1991, the consumer price index (average retail) rose 225 percent; it jumped 1200 percent in 1992. The CPI leveled off somewhat in 1993 at 190 percent; it is expected to be in the range of 50 to 80 percent this year. This year's rise is due, in part, to the institution of an 18 percent value-

[9] As of last June, Lithuanian companies were approximately Lt465 million in arrears in their tax payments. By mid-year, the budget deficit stood at Lt339 million, due mainly to shortfalls in tax collections. Total receipts for 1994 are expected to be 20 to 40 percent below budget, despite the introduction of the value added tax last May. Part of the shortfall is expected to be funded with Treasury bills, which were introduced early last summer.

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added tax on goods and services, as well as the increase in the price of electricity by 25 to 50 percent for commercial customers.

Average monthly wages, which have lagged behind those of the other Baltic nations, have risen from approximately $60 in late 1993 to $93 in May 1994. Officially, unemployment remains extremely low at 1.5 percent, but the real figure is probably much higher as many large industries have placed their workforces on unpaid leave. This trend is partially offset by the slow absorption of workers into new sectors of the economy.

B4. Economic Reform and Policy

Lithuania has made progress in the economic and social arenas, most notably in its privatization program; its price, currency, and trade reforms; and its attempts to maintain the social safety net. Most prices have been freed to world market levels, and subsidies are expected to be lifted soon on public transport, gas, and district heating. In July 1993, the Lithuanian currency (the litas) was introduced; since last April, the litas' exchange rate has been valued at 0.25 U.S. dollars.

Further progress in structural reforms will be critical to successful economic transition, especially trade and price liberalization, privatization, bank restructuring, and employment. Certain goods and services, primarily those related to consumer energy and transportation, continue to be subsidized by the state. Custom tariffs on imported goods have been eliminated or reduced to 10 percent. Privatization in Lithuania has been a model among the countries of the FSU and the CEE in certain respects, but it has lagged behind in others.[10] Nearly all small businesses, a significant number of industrial enterprises (60 percent), private housing, and approximately 30 percent of agricultural land were privatized largely through voucher privatization. However, large agricultural collectives and industrial enterprises remain under state control.

Sectoral Priorities

The government has identified several national priority sectors to which it wants to direct public and private investment, including:

- **Industry.** Paper, machine tools, chemicals, electronics, raw materials, and food production and processing.
- **Communications.** Enhanced postal and telecommunication services (including data transfer), and expansion of radio and television coverage.
- **Energy.** Improved efficiency in public and industry sectors and development of the means necessary to reduce dependence on the FSU for energy needs.
- **Transportation.** Reconstruction and rehabilitation of rail and highways linking Lithuania with its neighboring countries and modernization of major ports.
- **Environment.** Completion of wastewater treatment facilities, development of a rational system for managing hazardous and municipal wastes, reduction of noxious air pollution from industry and energy production.
- **Tourism.** Development of hotels, holiday centers, and transportation connections to Lithuania.

[10] It should be noted that only about 60 percent of the privatization vouchers issued have been redeemed. Unfortunately, the new shareholders often lack the sophistication to manage corporate operations and make difficult decisions, particularly during this early phase of economic and corporate restructuring.

B5. Banking and Credit

Long-term capital markets are almost non-existent in Lithuania. The volume of trade on the stock exchange is very thin, and no equity capital is being raised by private sector companies in that market. The debt market is dominated by approximately 12 full-service commercial banks. However, the three largest banks remain under state control. The lack of central bank supervision is especially problematic at a time when serious loan portfolio problems have been reported among banks. Four commercial banks failed last year because of loan defaults. The banks have enjoyed the luxury of wide spreads between their borrowing and lending rates. This is due to high short-term interest rates on their loan portfolios, where average interest rates are 50 to 60 percent per year, which are maintained by a combination of tight monetary policy, lack of domestic capital, and high risk. As a result, most commercial banking loans are short-term, geared primarily to working capital and trade finance facilities.

As inflation subsides and income becomes broader-based, the banking sector will become a more viable source of capital for private enterprise. Short-term rates on treasury bills have already fallen to approximately 25 percent, and a U.S. Treasury advisor working at the Lithuanian Central Bank expects bank rates to fall to under 30 percent next year. A proposed World Bank Financial Sector Adjustment Loan of $25 million is being proposed for the Lithuanian commercial bank sector. This could provide a much-needed infusion of funds to the capital-starved economy.

SECTION IV
PROJECT REVIEWS AND EVALUATIONS

During our mission, we visited the following sites: Akmenes Cementas, Achema, Kaunas Artificial Fiber Factory, Kedaina State Chemical Plant, Šiauliai Hazardous Waste Management Ventos Statybines, and Medziagos. Our recommendations for further technical assistance within the PPC framework follow.[1]

A. Akmenes Cementas

Akmenes Cementas was privatized in 1993, but the Lithuanian Government continues to own 35 percent of the company's shares. The rest of the equity is owned by management (40 percent) and the employees (25 percent). The plant has a production capacity of 3.4 million tons of Portland cement and related materials. However, production did not exceed 750,000 tons in 1993 due primarily to the fall in demand from the FSU, its principal market before Lithuania regained independence. Production was also curtailed because of interruptions in the supply of fuel from Russia.

The company exported 200,000 tons of cement to Finland, Sweden, Denmark, England, and Belgium in 1993. It expects to double that amount this year. The management of Akmenes Cementas seeks to expand its relationships in Western markets in an attempt to provide the company with stable outlets for its products.

Clinic and hospital data indicate a higher incidence of respiratory and throat ailments in the region of Akmene than in similar communities in Lithuania. It is difficult to accurately relate this morbidity data to the Cementas plant, since the area around the town of Akmene is also affected by emissions from the Mažeikiai oil refinery and the Ventos Statybines Medziagos building materials plant.

During our visit, we noted that the electrostatic precipitator (ESP) on the single kiln operated at the cement plant is not performing adequately. The management of the plant agrees that the dust emissions overshoot the government emission standards, even though emission levels for the plant are much lower that those found in similar plants in Eastern Europe. Emission of dust and SO_2 appear to exceed safe concentrations. The emissions originate from the high sulfur content fuel oil being used in the kiln operations and from the decomposition of gypsum ($CaSO_4$) in the calcination and burner flame zones due to the high kiln temperatures. The temperatures found in the burner and calcination zones are much higher than the minimum required for clinker formation, and this results in poor sulfur retention in the cement. The NO_x, CO, and soot emission levels are more than likely too

[1] A planned visit to Banga Electric, a producer of consumer electronics, was canceled at the last moment at the request of the company's management. We were informed that production facilities were shut down on that day and that many workers had been laid off. The company appears to be in the midst of a serious restructuring (downsizing) process and seems to be having a hard time competing with products imported from the Far East.

high, since the burners are not equipped with proper control equipment and have atomization problems. The color of the stack flume indicates incomplete combustion of fuel oil or production of a significant amount of soot.

A1. Production Processes

Akmenes Cementas uses a wet system for grinding and blending raw materials (limestone, clay, and some iron oxide). The raw materials are fed to long rotary kilns, which dry, preheat, and calcine raw materials as the mixture progresses down the kiln length. The heat is supplied by burning fuel oil at the discharge end of the kiln. The clinker at the oil burner end is cooled, mixed with gypsum, and ground into a fine powder called cement.

The plant, built in 1952, was based on Russian technology and has had several capacity increases since 1974. The management of Akmenes Cementas would like to make major modifications to the plant facilities in order to cut production costs and reduce the emission of gases and dusts. The emissions from the kiln appear to be serious in scope and are suspected to influence morbidity in the adjoining areas. In view of the current economic conditions, only one of the four larger kilns is being used at this time. However, Cementas expects domestic and overseas demand to expand to 1.4 million tons; exports would comprise about 400,000 tons of this increase. Thus, emissions can be expected to increase significantly.

The emissions that cause environmental and morbidity cases are related primarily to high energy consumption and process-based problems. Solving these problems may yield concurrent benefits for the environment, improve product quality, and lower energy consumption in the plant. The management of Cementas has formulated a plan for the refurbishment of the cement plant; we reviewed this plan during our site visit and a subsequent meeting in Vilnius with the technical director.

A2. Proposed Refurbishment Plan

The management of the company plans to add the necessary equipment to upgrade the kilns one by one, as soon as precise data on kiln conditions and optimal levels of inputs (energy, air, limestone, iron oxide, etc.) are determined.[2] The cement kilns do not have continuous CO, SO_2, NO_x, and O_2 monitoring equipment. As a result, the cement production process is based on estimates of input needs to produce quality cement. Without continuous monitoring equipment, the plant cannot accurately determine fuel inputs into the kiln, air supply for the combustion of fuel oil, or correct amounts of limestone injection/loading to capture the SO_2.

The equipment required for the upgrade cannot be adequately determined without prior optimization and testing. This effort should be performed over a number of months

[2] Whether the objective is the improvement of emission levels, minimization of energy consumption, or optimization of process conditions through the installation of new equipment, the procurement and installation of capabilities to continuously monitor the effluent gas streams from the kiln must come first.

during actual cement production, since the procedure for pinpointing optimal conditions involves trial and error. The existence of gas emission monitoring equipment is essential during the testing period since emission levels are the only real indicator of equipment performance.

It is not certain how many kilns will be upgraded or retained for future production. However, the following upgrades, which pertain to at least one kiln, equipment purchases, or process refurbishments are anticipated over the next few years:

- Replacing or refurbishing oil burner(s) on the kilns and simultaneously installing control/monitoring equipment. The objective is to reduce NO_x and CO emission levels through adjustment of primary and secondary air and use of correct air-to-fuel ratios. Coupled with the process optimization effort, this specific investment plan is expected to reduce energy consumption by about 15 percent per unit ton of cement produced.

- Providing capabilities for limestone injection in the flame area around the burner space, in addition to the limestone used in wet feed, for cement raw material synthesis. Optimizing limestone feed and injection and reducing water in the feed will enhance the efficiency for capture of SO_2 in the kiln and reduce energy use.

- Installing advanced batching equipment for the preparation and introduction into the kiln of appropriate raw material solid inputs including recycled solids from the ESP. Performance of the ESP is related to the inputs into the kiln.

The management of Cementas is currently considering the procurement of equipment from Danish sources through a soft loan arrangement of DKK 20.4 million. The much-needed renovation of kiln operations will include equipment for cooling clinkers, a new chain system for the kiln, a separator for the cement mill, equipment for sealing the kiln, and other related equipment.

A3. Recommendations

Continuous monitoring equipment to control plant emissions is critical. Emissions must be controlled now and reduced in the future by optimizing plant operations and processes for producing cement. We believe that the product and process restructuring plan is more environmentally friendly than the existing production arrangements. The plan cuts down on emissions significantly and is only the first in a series of steps that will be required in the future. The plan will likely strengthen the company financially, enabling it to upgrade its facilities and make further investments to improve plant performance and reduce hazardous chemical emissions.

Accordingly, we strongly recommend that USAID provide technical assistance in the procurement and installation of continuous emission monitoring equipment for the single operational kiln being used for cement production. This TA should include advising the plant management on equipment and helping finance its purchase from U.S. sources through guarantees from the EXIM Bank. The cost of the required equipment is expected to be approximately $300,000 to $400,000.

B. Achema

Achema, formerly known as the Jonava State Enterprise "Azotas," is one of two large fertilizer manufacturing companies in the Kaunas region of central Lithuania. The region is highly industrialized, and air pollution is of particular concern to local inhabitants. The plant facilities of Achema are located in the small town of Jonava (population 20,000) on the banks of the Neris, an important tributary of the Nemunas River.

The company has been privatized, with about 30 members of its senior managers owning 96.4 percent of the stock. The rest is owned by 4,000 other employees. Achema manufactures nitrogen-based fertilizer chemicals and other industrial chemicals.

B1. Current Conditions

Urea and ammonium nitrate are the primary fertilizer chemicals synthesized at the Achema plant. The primary raw material input is natural gas, supplied from Russia by Gazpromm. High sulfur fuel oil is also burned in the boiler facilities, even though the primary fuels used are natural gas and waste gases from the production processes. The company has the capacity to produce the following annual quantities of products:

Liquid ammonia	615,000 tonnes
Ammonium nitrate	430,000 tonnes
Urea	240,000 tonnes
Methanol	102,000 tonnes
Urea formaldehyde resins	78,000 tonnes
Polyvinyl acetate resins	9,000 tonnes

Ammonia is made at Achema from natural gas using well-known standard technologies. Natural gas is cleaned and then converted to syngas in a high pressure and temperature reactor. Part of the syngas is diverted to another processing plant to manufacture methanol, and the rest is converted to ammonia. Ammonia is oxidized to nitric oxide. Through a series of reactions, the oxide is predominantly converted to NO_2, which is absorbed in absorption columns to form nitric acid. Ammonium nitrate fertilizer is produced from the nitric acid and ammonia.

Another important chemical fertilizer produced in the plant is urea, a natural chemical widely used as nitrogen fertilizer. It is synthesized by reacting ammonia with carbon monoxide at high pressure. Some of the urea is used to synthesize other chemicals or formulations, such as urea formaldehyde resin and liquid nitrogen fertilizer.

The numerous chemical reactions and processing steps conducted at the plant involve complicated multiple chemistries in a wide variety of processing steps. According to plant personnel, these generate total annual emissions of the following magnitude:

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CO	2,500 tons	SO_2	450 tons
NH_3	2,200 tons	CH_3OH	310 tons
NO_x	1,100 tons	Vinylacetate	12 tons
NH_4NO_3	350 tons	HCHO	8 tons
Urea	120 tons		

The emissions of gases include some species that are dangerous for humans, such as NO_x, SO_2, NH_3, and CO. Other critical species emitted into the atmosphere include solid particles, such as ammonium nitrate and urea, from the prilling operations used to produce granular fertilizer from solution melts. These emissions are harmful when inhaled. Excessive amounts of nitrogen fertilizer into bodies of water can also have an impact on their ecology.

Achema measures ambient air conditions in Jonava as required by health and environmental authorities. The management told us that emission levels from the plant and ambient air conditions in the area are within the prescribed limits set by the Lithuanian government. However, they also acknowledged that acceptable emission levels have been exceeded on occasion, and that some of the measurements were performed during favorable wind and plant operating conditions. During the site visit, our team noticed a chemical odor emanating from plant emissions.

The Achema plant is not equipped with adequate automation and monitoring equipment. The potential for increased emissions with increased production remains significant, since it is not possible to control precisely the stoichiometry for inputs into the reactors. This in turn may cause high levels of unreacted species in discharge streams. Cleanup equipment does not function well when variations of pollutants in the streams are not continuously and immediately monitored.

The plant facilities do not appear well maintained, and significant corrosion effects were observed on plant equipment exposed to the elements. This may be due partially to exposure to emissions of acidic gases from the plant and to fertilizer salt expelled from the prilling operations into the atmosphere.

B2. Proposed Plan for Production and Pollution Control

Achema management has recently formulated an operational plan for production of its nitrogen-based fertilizers that would significantly reduce emission levels of ammonium nitrate, ammonia, and urea. Market analysis shows that the production of alternative nitrogen-based fertilizer products will allow the company to penetrate new markets in Europe and the United States, and at the same time improve productivity and increase profits. The product restructuring plan involves switching production from granular urea and ammonium nitrate to liquid nitrogen fertilizer chemicals, which are in great demand in the West. Tentative marketing arrangements have already been made with potential importers.

The proposed plan calls for the procurement of $3 million in equipment, including mixing reactor vessels, to prepare liquid chemical formulations from urea and ammonium nitrate streams obtained from existing reactors and separation operations. This hardware will be procured locally or from Russia. The second component of the plan calls for acquiring

and installing automation and monitoring equipment, which will be supplied from Rosemont (in the United States). The cost of the equipment is approximately $1.2 million.

The equipment will monitor and precisely control the existing reactor for synthesizing ammonium nitrate from nitric acid and ammonia and automate and control the new mixing reactors that produce liquid fertilizer chemicals from urea and ammonium nitrate. Producing liquid fertilizer to replace granular products is expected to reduce ammonium nitrate, ammonia, and urea emission levels by about 850 to 900 tons annually by reducing prilling operations and better controlling and monitoring reactors.

Achema management recognizes that additional investments will be needed to improve the facilities and further control other reactors and emission suppression units. However, these investments are not possible without better prospects for markets and profits.

B3. Recommendations

The emissions from the Achema plant cannot be accurately estimated because of the lack of reliable data. However, we suspect that the levels of pollution from the plant are higher than those reported, based on discussions with local experts and anecdotal comments made during our visit. Emission levels need to be improved, and the proposed restructuring plan is the first step for better environmental control and reduced emission levels. Achema has raised the funds to purchase the required hardware (the first phase referred to above). However, the U.S. automation equipment needed initially to reduce emissions by 900 tons has yet to be secured.

The second phase of the operation plan (acquisition and installation of monitoring and automation equipment) could best be financed by the U.S. EXIM Bank. This is especially the case since an American equipment manufacturer (Rosemont) has been identified by the company. The company does not have a well formulated business plan, however, and little is known about its financial status. We feel that Achema will be hard pressed to produce the required documentation without additional assistance. Therefore, we recommend that USAID provide the services of an agrichemical business analyst with a thorough understanding of market conditions, a financial analyst, and a chemical engineer for up to two weeks in Lithuania. Additional time may be needed by the business and financial analysts to assist USAID and EXIM Bank in the documentation of the loan guarantee if the proposed project is determined to be bankable.

C. Kaunas Artificial Fiber Factory

The Kaunas Artificial Fiber Factory is owned by the Kaunas Joint Stock Company, in which the Lithuanian government holds 20 percent equity and the employees own 14 percent. The remainder is owned by various investment companies. Until 1991, the facility produced di-acetate and tri-acetate cellulose yarns from imported cellulose acetate flakes. The total capacity of the plant is about 14,000 tons of yarn annually. Approximately 90 percent of the yarn was exported to the FSU. Due to poor economic conditions in these markets and the unavailability of other markets, the plant is currently operating at about 7,000 tons per year. The management is exploring opportunities for restructuring the capacities toward other products based on cellulose acetate.

C1. Current Conditions

The main emission problem at the plant concerns acetone, which is used as a solvent to dissolve cellulose bi-acetate. The resulting solution is drawn through spinerettes. Each mono-filament emerging from the drawing tanks wet with solvent is dried by heated air. The solvent-laden air is drawn into beds of activated carbon contained in huge absorption towers. These beds are saturated by air that is pulled from the spinning operations and the factory floor. The factory floor receives emissions of acetone from other operations involving cellulose processing within the plant. When fully saturated, each bed of activated carbon is desorbed with steam, and the resulting steam-acetone mixture is cooled, condensed, and distilled to recover the acetone for reuse within the process.

The production of yarn from cellulose tri-acetate has been discontinued. Tri-acetate-based yarns are based on cellulose solvation processes using a solvent mixture of methylene chloride and ethanol. Methylene chloride and ethanol are not hazardous or proven carcinogenic substances. However, methylene may accumulate in the liver after long exposure; the long-term health effects are unknown. When economic and market conditions warrant, the cellulose tri-acetate part of the plant will be used to produce additional bi-acetate yarn.

Acetone is neither a hazardous nor a carcinogenic substance. When it is used within the accepted exposure standards of most facilities in the world, it has no significant health effects on humans. The emissions of acetone from the plant produce only a mild odor near the plant. The Kaunas fiber plant is actually operating within the Lithuanian occupational exposure standard of 200 mg/m^3 (85 ppm). This standard is considerably stricter than exposure standards in the United States, Germany, the United Kingdom, the Netherlands, France, or Canada, each of which has adopted an exposure standard of 1,780 mg/m^3 (750 ppm). The Lithuanian standard is also considerably stricter than exposure standards of very competitive acetate yarn producing countries, such as Japan (480 mg/m^3), Brazil (1,780 mg/m^3), and Korea (1,780 mg/m^3). The ambient conditions in the surrounding areas, including houses 300 meters from the facility, are well within Lithuanian ambient air quality standards.

The management of the fiber plant would like to reduce acetone losses from the plant further, primarily because the plant must pay significant fees/fines when the concentration of acetone exceeds the maximum allowable concentration.[3] Acetone losses from the plant in 1991 were 360 kg/ton of yarn produced, a total of 1,080 tons based on the annual yarn production. Along with losses in acetone, there are losses in energy, since warm air is used to vaporize acetone from the yarn filaments and to replenish the factory floor air in the plant to maintain workplace exposure standards. Energy is also used in processing to recover acetone. The energy and acetone losses are significant economic issues for the plant, especially in the new competitive environment.

[3] Kaunas plant management estimates that abiding by the Lithuanian acetone maximum concentration costs the facility approximately Lt200,000 per month on average; 20 percent of this is estimated to be in energy costs.

C2. Recommendations

We recommend that the Lithuanian government relax its acetone exposure standards by increasing the maximum concentration level to those applied in other advanced industrialized countries. The present standards, inherited from the FSU, are too strict and impose significant economic handicaps for the fiber plant. The energy costs in the manufacturing process are about 15 to 20 percent of the cost of production. This cost may be reduced by approximately 50 percent when reasonable exposure and ambient air standards are applied.

We see no need for follow-up technical assistance within the PPC framework. However, USAID may consider extending the technical assistance program being provided by WEC. The current program, which is soon to end, has yielded important environmental results and economic results for the enterprise. In the last year, the losses in acetone per ton of yarn produced has been brought down from 360 kg/ton of production to 280 to 290 kg per ton. Continuation of the program may contribute to further emission reductions and yield economic benefits as well.

D. Kedainiai State Chemical Plant

Kedainiai State Chemical Plant, a privately held enterprise, produces monoammonium phosphate (MAP) and superphosphate (SP) from rock-phosphate, sulfuric acid, and ammonia. Sulfuric acid is synthesized at the plant from sulfur imported from the Ukraine or obtained from the Mažeikiai refinery in Lithuania. The rock-phosphate is imported from Russia. The plant also produces aluminum trifluoride from the fluoride gases absorbed in the scrubber-waters from the phosphoric acid and superphosphate synthesis operations. The plant exports a major portion of its fertilizer production to Eastern and Western Europe. Its maximum annual capacities are as follows:

Sulfuric Acid	1,500,000 tons
Powder Single Superphosphate	300,000 tons
Granulated Single Superphosphate	275,000 tons
Aluminum Trifluoride	6,000 tons
Phosphoric Acid	156,000 tons (P_2O_5)
Monoammonium Phosphate	151,000 tons (P_2O_5)

Process steam is produced in the company's own boilers from high sulfur content fuel oil and heat recovered in the sulfuric acid production plant. The fertilizer plant also cogenerates some of the electricity needed to run the facilities.

D1. Current Conditions

The major gas emissions from the synthesis processes and boiler facilities consist of SO_2, SO_3, NH_3, H_2SO_4, CO, NO_x, and fluorine-based gaseous emissions. The plant managers state that the synthesis and emission control process units operate essentially within the prescribed emission and environmental standards with respect to all emissions into the atmosphere. According to plant management, emissions rarely exceed the environmental standards.

The air quality around the plant and in the surrounding areas of Kedainiai has been within ambient air quality standards observed in Lithuania. The company periodically measures air quality in the direction of wind flow at locations that are 1.5, 3, and 5 kilometers from the plant. Since continuous monitoring of ambient air quality is not common in Lithuania, the plant may not be in total compliance. However, the general ecology around the plant appears to be quite healthy. The 1989 and 1990 pollution indices for Kedainiai at the peak of economic activity in Lithuania were significantly lower than those of other major cities, including Vilnius, Klaipeda, and Kaunas.

The plant facilities are relatively new, and many of the major units have been installed in the last 15 years using the best available Russian technology. Gas and emission control equipment had been installed on major process equipment, except for the boiler facilities. The plant, except for the boiler facilities, is adequately automated.

According to management, the major SO_x emissions from the Kedainiai plant result from the boiler operations, and not the sulfuric acid, phosphoric acid, and phosphate production operations. The fuel oil used in the boiler plant has a sulfur content of between 2 and 3.5 percent. This fuel oil is supplied to the plant at about $70 per ton and is considerably cheaper than gas or alternative low sulfur liquid fuels on the world market. During March 1993, the fertilizer plant emissions of all species were about 138 tons; the boiler and power plant emissions totalled about 50 tons. Since the plant operates essentially within emission and air quality standards, there is little incentive to switch to better quality fuels.

Process wastewater from the plant processes is not discharged, but is used in a recycle closed-loop process. The water contains some P_2O_5 and cannot be let out and discharged. The water used for cooling is kept in a separate closed-loop in a lagoon and is purged periodically into the Neveszis River to avoid build-up of salts. Makeup water for cooling is obtained from the river. Rainwater is collected from a 10 km catchment and stored in a lagoon to serve as an equalization tank. Fish are bred in the lagoon as evidence of its quality and suitability for discharge.

The plant produces gypsum in neutralization operations to remove the sulphate ion present in the wastewaters from the scrubbing operations. The calcium sulphate is recovered and piled as a hugh mound of gypsum adjacent to the plant. Since this storage is above ground in the open, the mound is diked to prevent the leachate material from running into the soil. This leachate is recycled to the process wastewater, since it contains traces of acids. The mound of gypsum (over 100 meters high) probably contains some heavy metals, which are usually present in rock-phosphate traces.

D2. Recommendations

In the past year, the Kedainiai plant has benefited from USAID-sponsored technical assistance programs on waste minimization that WEC provided. The Kedainiai fertilizer plant received equipment grants worth about $25,000 and appreciable technical assistance. We see no need for technical assistance within the PPC framework. The fertilizer plant appears to be operating in a satisfactory manner. However, incremental gains are still possible, and the management has expressed a desire for additional assistance from WEC to

help improve fuel oil burner performance for the boiler plant. Successfully developing solutions for burner-related problems may result in reducing soot emissions, as long as atomization problems can be eliminated. Controlling air to fuel ratios may also improve the fuel efficiency for raising steam and peripherally decrease output of SO_x emissions into the atmosphere through decreased fuel needs.

The management also perceives a need for technical assistance on the recovery of aluminum trifluoride (which makes sense economically) and silicon dioxide for use as a filler in paper manufacturing.

E. Šiauliai Hazardous Waste Management

During our visit to the northwestern city of Šiauliai, we met with Municipal Environmental Protection Department officials, visited the site of the uncompleted Šiauliai wastewater treatment facility, including the nearby hazardous waste disposal site, and toured the premises of the Stumbras and Elnias tanneries. These are the oldest tanneries in Lithuania and account for 70 percent of the hazardous wastes disposed by its tanneries. They are also the largest volume contributors of industrial wastewater to Šiauliai's wastewater treatment plant.

E1. Current Conditions

The city of Šiauliai requires industry to provide minimum treatment of wastewater before discharging it into the city's system. This requirement pertains mainly to biological oxygen demand (BOD) level, hazardous metal content, and fat in discharged water. In general, the wastewater discharges from the two tanneries do not meet the municipal standards for discharge of waters into the city's system, particularly in the area of chromium content. When we asked about the chromium concentrations in the discharged wastewater, we were told that one of the tanneries tries to meet the requirement on chromium concentration by diluting the wastewater with fresh water before discharging it into the municipal wastewater system. Based on the average concentrations of chromium in the plant wastewater, it appears that the tannery is discharging two or three times the amount of water necessary because of the chromium requirement. The municipal system is thereby loaded with discharged water at a time when the municipality is actually short of treatment capacity to process wastewater.[4]

The most important issue regarding hazardous waste in the two tanneries is the storage of hazardous waste and sludge. In 1992, the municipality, the tanneries, and a number of electronic firms formed Toxica, a company designed to manage hazardous waste storage in the Šiauliai region. Toxica has acquired a site to store industrial hazardous waste adjacent to the municipal wastewater treatment plant under construction about 10 km from Šiauliai. The sludge and hazardous waste from the tanneries are being accumulated in two dedicated pits that have been dug at this site. One of these unlined pits is already filled to

[4] Stumbras had planned to build its own internal wastewater treatment facility. However, due to current economic conditions, work on the facility—which had been about 70 percent complete—was stopped because financing was not available. The Lithuanian government recently agreed to guarantee a $2 million loan made available to the plant from the Danish government.

capacity. As more waste accumulates, the tanneries plan to dig additional waste pits. The managers of the tanneries informed us that the ground at the pits was tested by hydrologists and geologists, and that the pits are safe for sludge and waste storage.[5] This fact was not verified.

E2. Recommendations

As mentioned in the summary, the situation at the Šiauliai hazardous waste storage site, while not posing an immediate health threat, appears to be environmentally unsound and dangerous to the local population. Water-bearing sludge waste containing significant amounts of chromium (estimated 1 percent chromium in solution) from tannery operations is stored in open pits. While the site is maintained as a temporary holding area until the permanent hazardous waste facility is completed, it could take several years for this facility to be completed. Thus, the danger of the temporary holding pits could be magnified over time.

Local environmental officials told the team that the pits were located above a natural horizon of clay that was sufficient to keep the waste from leaching into groundwater sources. This was not confirmed, but was believed incorrect, since the minimum thickness standard of a natural clay horizon for similar facilities in the West would be seven feet. Given the fact that nearly all of the drinking water in the region is drawn from underground sources, leaching of chrome into the water supply could pose a serious risk. Moreover, the possibility of the pits' contents overflowing onto unprotected soil seemed a distinct possibility, because the pits are filled to capacity, rainfall in the area is high, and water is slow to evaporate from the pits.

Although we see definite merits to the development of the common hazardous waste storage facility planned by Toxica, we were not convinced that the city and the waste management company had the capability of recovering the capital and recurrent costs required to build and sustain the operations of the proposed facilities. We were also not convinced that the required capital outlays were justifiable given the limited volume of waste involved. Hazardous waste treatment facilities are not economical on a small scale. Furthermore, the fees anticipated per ton appear to be too low.

After long deliberations, we recommended that Mr. S. Mimura of the Japan Special Fund further investigate the proposed project to determine whether the fund can finance a feasibility study. He informed the team that he had requested additional information from the city to enable him to determine follow-up activities.

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[5] Another issue facing the tanneries is their lack of sludge dewatering equipment. Access to sludge dewatering technology can minimize their hazardous waste levels. The sludge from the tanneries consists of 80 percent water. Dewatering equipment could cut volumes greatly and reduce the level of chromium contained in the disposed material.

F. Ventos Statybines Medziagos

Ventos Statybines Medziagos, or the Ventos Construction Materials Company, is located in the small town of Venta, south of two other important industrial sites (near Šiauliai): the refinery in Mažeikiai and the cement plant at Akmene. Together, the three industrial sites contribute significant pollution to the triangular area between them. There are no adequate health statistics on morbidity in the region, but anecdotal information from clinics and hospitals in the area suggest high rates of respiratory and throat ailments. There may be other undocumented health effects associated with the sites, but these were not discovered by the team.

F1. Current Conditions

Facility production consists mainly of powdered limestone, which is produced by milling crushed limestone (from a nearby quarry) as well as powdered lime, which is produced through the decomposition of limestone during calcination reactions at high temperature in rotary kilns. Other products, including slaked lime and building material starters, are also made from limestone, lime, and other materials. It is apparent that major investments may be needed to suppress the dust emissions associated with inadequate ESP on the milling operations. Possible solutions include: enlarging electrode plates, adding better electron emitting electrodes with high voltage, and optimizing the control for the ESP to increase the particulate capture efficiency.

The lime calcination operation in the kilns may be a source of significant particulate emissions due to the lack of ESPs on the kilns. The kilns are equipped with six cyclone separators to remove dust from the gases emitted from the lime calcination operations. Cyclone dust capturing efficiency for particulates below 5 or 10 microns is very poor, and lime particulates below these ranges are very harmful to the human respiratory system.[6]

Other emissions at the Ventos plant are closely tied to production and product quality problems. The lime product from the calcination kilns is not of quality grade. In addition, the heavy oil burners do not burn fuel well and produce black emissions from the stack, apparently from soot resulting from poor combustion and inadequate atomization of the fuel oil. Also, NO_x emission measurements were not available to us. They would probably indicate high emission levels, since burners on the kilns are not equipped with control and automation devices or provided with two-stage air supply devices to minimize flame temperatures and reduce NO_x formation. SO_2 emissions may also be high since the fuel oil has high sulfur content. The use of fuel oil is likely to be appreciable on a unit product basis, as limestone decomposition is accompanied by an endothermic heat of reaction.

The Ventos operations require large capital outlays to reduce emissions and upgrade operations to improve production quality. However, it was not apparent to us that such improvements would lead to economically sustainable operations. Lime production is down

[6] Cyclones may be used as a first-stage capture device for dust from kilns. The sole reliance on cyclones to prevent dust emissions is not an acceptable solution for dust control problems, especially if the dust is fine and originates from chemical operations.

to about 30 percent of capacity, and only one kiln out of four is in operation. During the Soviet era, much of the production was sold to Russia, Belarus, and Latvia. These markets have either shrunk or are no longer available. With free market conditions and competition, the low product quality may prevent access to traditional and new markets.

Limestone milling operations are down to 12 percent of capacity, and the sustainability of operations with such large idle capacity is questionable. Ventos reduced the number of employees by two-thirds after the fall in demand for its products. The company claims that demand is increasing, and that the operations are breaking even financially. Overseas competition is likely to be particularly tough for Ventos since the production of lime, slaked lime, and limestone powder are well-developed industries in much of the world.

F2. Recommendation

Our visit to the Ventos plant was short and we were unable to obtain detailed information about the operations. We believe that a thorough assessment of the physical condition of the plant facilities and engineering processes is a prerequisite to major TA efforts within the framework of the PPC. It is also important to determine the viability of the enterprise and its market outlooks before any investment decisions are made. Accordingly, we propose to limit future TA to WEC's waste minimization program. Such assistance should focus on low-cost/no-cost approaches to address burner-related and dust emission control problems.

ANNEX
MEETINGS

In the course of our three-week mission to Lithuania, the members of our team met, either individually or as a group, with several government officials at the national and local levels, representatives from multilateral development institutions, and industrial managers. The information collected from these sources was supplemented with valuable insights from the Office of the USAID Representative in Vilnius and the staff of the World Environmental Center.

Office of the USAID Representative

Mr. John Cloutier, USAID Representative in Lithuania.
Mr. Nicolas Jenks, Project Development Officer.
Mr. Vaslav Stecevic, Project Specialist.

Ministry of Environmental Protection

H.E. Mr. Bronius Bradauskas, Minister of Environmental Protection.
Mr. Arunas Kundrotas, Secretary of the Ministry of Environmental Protection.
Mr. Rapolas Liužinas, Secretary of the Ministry of Environmental Protection.
Ms. Marija Terioshina, Chief Engineer, Atmosphere Protection Unit,
Mr. Arvydas Dragunas, Chief Economist, Economics and Programming Division.
Mr. Winfried Pietersen, Senior Advisor, Environmental Policy and Law (provided under the auspices of EU Phare.

Ministry of Finance

Ms. Ruta Skyriene, Head of the State Debt Management Division, Ministry of Finance.
Mr. Algimantas Križinauskas, Head of Enterprise Finance Department, Ministry of Finance.

Ministry of the Economy

Mr. Edmundas Juozenas, Director, Investment Department.
Mr. Rimantas Zabarauskas, Head, Public Investment Program Unit.

Ministry of Industry and Trade

Mr. Stasys Ivanauskas, Head of the Division of Secondary Raw Materials and Waste.

Minsitry of Health

Mr. Zenonas Stanevičius, Director, National Center of Hygiene.

Ministry of Energy

Mr. Dangiras Mikalajunas, Director of the Energy Agency.
Mr. Vytautas Guzys, Chief Engineer, Energy Equipment Operations.
Mr. Paul Lewington, Economist, ERM Energy (U.K.), consultant to the ministry, provided under the auspices of EU Phare.
Mr. Morten Sondergaard, consultant to the ministry, provided under the auspices of EU Phare.

Other Meetings in Vilnius

Mr. Stephen Goranson, Information Management Branch, Planning and Management Division, U.S. Environmental Protection Agency, Region 5.
Mr. Alan Nudelman, Data Management Coordinator, Information Management Branch, Planning and Management Division, U.S. Environmental Protection Agency, Region 5.
Mr. Rimantas Aukštuolis, Lietuvos Banka (Central Bank, supported by USAID)
Dr. Jonas Kapturauskas, Country Coordinator for Lithuania,World Environmental Center
Ms. Gretchen Mikeska, Project Manager, World Environmental Center, Waste Minimization Program in the Baltic States.
Mr. Inesis Kiškis, Regional Environmental Specialist, the World Bank.
Mr. S. Mimura, Project Director, Japanese Special Fund (co-sponsored by the Regional Environmental Center for Central and Eastern Europe).
Dr. Rimantas Budrys, President, Lithuanian Engineering Ecology Association.
Dr. Jonas Motiejunas, Head of Technical Council, Lithuanian Engineering Ecology Association.
Dr. Edmuntas Levitas, President, Upinis Limited (Engineers and Consultants)

Meetings Outside Vilnius

Mr. Algimantas Mituzas, Technical Director and Member of the Board of Directors, Akmenes Cementas, Akmene.
Mr. Stanislovas Janeliunas, Chief Technologist (Chief Engineer), Akmenes Cementas, Akmene.
Ms. Vida Stasiunaite, Vice Mayor, City of Šiauliai.
Mr. Romaldas Šemeta, Chief, Environmental Protection Department, City of Šiauliai.
Mr. Jonas Gricius, Technical Director, Ventos Satybines Medziagos (Ventos Construction Materials Company), Venta.
Mr. Alfonsas Paulavičius, Technical Director, Kaunas Joint-Stock Company (artificial fiber plant), Kaunas
Mr. Albinas Pilkauskas, Director of Technological Process and the Development of Production, Kedainiai State Chemical Plant
Mr. Jonas Sirvydis, Technical Director and Member of the Board of Directors, Achema, Jonava.
Dr. Romuldas Piktys, Economic and Finance Director, Achema, Jonava.

Mr. Valdemaras Kuzmickas, Commercial Director, Elnias Joint Stock Company (tannery), Šiauliai.
Sigitas Vilčiauskas, Technical Director, Siauliu Stumbras (tannery), Šiauliai.