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Argentina
Managing Environmental Pollution: Issues and Options

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Currency Equivalents

Currency Unit - Argentine Peso (A$)

US$1 = A$1

Weights And Measures

The Metric System is used throughout this report.

Fiscal Year

January 1 to December 31

Acronyms

AA	Gran Buenos Aires Water Utility (*Aguas Argentinas*)
AMBA	*Area Metropolitana de Buenos Aires*
CEAMSE	Metropolitan Area of Buenos Aires Solid Waste Disposal Company (*Coordinación Ecológica Area Metropolitana*)
COFAPYS	Federal Water and Sanitation Council (*Consejo Federal de Agua Potable y Saneamiento*)
COFEMA	Federal Council for the Environment (*Consejo Federal del Medio Ambiente*)
ETOSS	Water Regulatory Entity for Gran Buenos Aires (*Ente Tripartito de Obras y Servicios Sanitarios*)
EU	European Union
GBA	*Gran Buenos Aires*
IBRD	International Bank for Reconstruction and Development
IDB	Inter-American Development Bank
INCYTH	National Institute for Science and Water Resources (*Instituto Nacional de Ciencia y Técnica Hídrica*)
MERCOSUR	Southern Cone Common Market (*Mercado Común del Sur*)
NAFTA	North-American Free Trade Agreement
OPS	Pan-American Health Organization (*Organización Panamericana de Salud*)
SERNAH	National Environment Secretariat (*Secretaría de Recursos Naturales y Ambiente Humano*)
WHO	World Health Organization

Different sources use different definitions for terms that describe the agglomeration in and around Buenos Aires. In this report, the term *Gran Buenos Aires* (GBA) refers to the following jurisdictions: Capital Federal, Avellaneda, Lanús, Lomas de Zamora, Almirante Brown, Esteban Echeverría, La Matanza, Morón, Tres de Febrero, San Martin, Vicente López, San Isidro, San Fernando, Tigre. This area coincides with the concession area of *Aguas Argentinas*. The term *Area Metropolitana de Buenos Aires* (AMBA) refers to the above listed jurisdictions plus Quilmes, Berazategui, Florencio Varela, Merlo, Moreno, and General Sarmiento. The attached map shows the extent of GBA and AMBA.

Abbreviations

BOD	Biochemical Oxygen Demand
CFC	Chlorofluorocarbon
COD	Chemical Oxygen Demand
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GNP	Gross National Product
HC	Hydrocarbon
NPV	Net Present Value
ODS	Ozone Depleting Substances
PM_{10}	Particulate Matter (less than 10 micron in diameter)
PPP	Purchasing Power Parity
RAD	Restricted Activity Days
SPM	Suspended Particulate Matter
TSS	Total Suspended Solids
VOC	Volatile Organic Compounds
WTP	Willingness to Pay

This report is based on the findings of a mission that visited Argentina in September 1994. The mission included Messrs/Mmes: Andrés Liebenthal (Mission Leader and Principal Economist), Joachim von Amsberg (Economist), Antonio Estache (Senior Economist, Institutions), Sergio Margulis (Economist, Benefit Valuation), Gordon Hughes (Economist, Industry and Trade), Bekir Onursal (Industrial Pollution Specialist), Sabine Cornelius (Economist, Urban Transport), Alberto Ninio (Legal Specialist), Nora Clichevsky (Architect, Consultant), Emanuel Idelovitch (Sanitary Engineer, Consultant), Claudio Joseph (Industrial Specialist, Consultant), and James Listorti (Environmental Health Specialist, Consultant).

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1. Pollution Problems And Their Costs

Background and Objective

1.1 *Overview.* Argentina is suffering from a variety of pollution problems that are more serious than one would expect in a country of its upper-middle levels of income and economic development. Environmental pollution causes significant damages in specific locations and imposes large costs on poor segments of the urban population in some low-income neighborhoods. On a national scale, however, the damages arising from pollution are modest. In general, pollution damages are limited due to low population density, favorable geographic conditions and a well-educated population that is able to take effective measures to protect itself from the worst impacts of pollution.

1.2 Argentina's pollution problems are mainly the result of the gradual increase of the urban population and industrial development, combined with an inadequate regulatory framework and a long standing deficit in sanitary and waste treatment infrastructure. Decades of neglect and lack of coordination have led to an uneven and confusing regulatory and institutional framework for environmental management. Despite increasing efforts, the Government does not yet have a well developed strategy to address environmental pollution.

1.3 The most critical constraint for improving the management of pollution in Argentina is the absence of clear institutional responsibility for environmental management and the lack of effective enforcement. Government institutions charged with environmental policies are weak, their responsibilities are fragmented, and enforcement is inadequate in many areas. The institutional framework for environmental management involves a web of overlapping national, provincial and municipal agencies. The resulting unusually complex system of laws, regulations and authorities has led to unevenness and uncertainty in the enforcement of regulations, and opened many opportunities for polluters to evade compliance with environmental objectives.

1.4 Argentina's environmental pollution problems are not insurmountable. Their effective management requires the development of a clear vision of the type of environment that the country is committed to attain, a comprehensive (cross-sectoral) strategy for pursuing the vision, and, based on that strategy, significant improvements in the regulatory framework to provide appropriate incentives for environmentally sustainable decision making, improvements in the management of sector agencies, and investments. Because of the long neglect of the environment, many of the low-cost options for reducing pollution have not yet been implemented, and the financial resources required for the implementation of a sound pollution control strategy are well within the capacity of the country.

1.5 On the other hand, unless corrective measures are taken, pollution problems are likely to become much worse. As industrialization and urbanization continue, growing industrial discharges, combined with pollution from urban households (sewage, garbage and vehicle emissions), will pose an growing threat to public health, erode the cities' attractiveness as a locus of investment, and possibly affect the marketability of Argentina's exports abroad.

1.6 As a complement to the structural reforms of the economy that have taken place in recent last years, the Government needs to develop a strategy for addressing environmental pollution. To develop such a strategy, the Government will need (i) an integrated synthesis of the available information on the physical, social and economic dimensions of the pollution

problem, (ii) an overview of the multiplicity of options available to address the problem, with recommendations on the best choices, and (iii) an outline of the policy and institutional implications of the recommended solutions. The objective of this sector report is to assist the Government in the development of this strategy.

1.7 *Background.* The problems in the management of environmental policy cannot be properly understood without considering the macroeconomic environment in which the Government operates. When the current Government took office in 1989, Argentina was gripped by recession and monthly inflation of up to 200 percent. The new Government initiated profound structural reforms that were remarkable for the scope and speed with which they were implemented. As part of the transformation of the economy and the state, the Government is making a strong effort to complete structural reforms involving the privatization of public services (including water supply, sewerage and solid waste disposal) and the decentralization of regulatory responsibilities and social programs to the provinces and municipalities.

1.8 For the last few years, the macroeconomic reform program has brought Argentina price stability and economic growth unknown for several decades. While profound structural reforms have been undertaken, the newly gained stability remains vulnerable to external shocks such as the rise in international interest rates in early 1994 and the Mexico crisis. A recent increase in the trade deficit has fueled concerns that the fixed exchange rate may hurt the competitiveness of Argentine exports[1]. On the other hand, the Convertibility Law is considered a cornerstone of the reform program that is critical to maintaining trust in monetary stability.

1.9 During the implementation of the stabilization program and the privatization of government services, environmental considerations were not a priority. Increasing Government intervention for the protection of the environment was seen as counterproductive to the effort to attract private investors. Also, the continuing success of the stabilization program depends critically on maintaining and improving the competitiveness of Argentine's exports. In this situation, there is strong resistance against all policies that could potentially increase production costs, such as tighter pollution control.

1.10 The decentralization of government functions has resulted in jurisdictional confusion among the national, provincial, and municipal levels. This confusion contributes to the ineffectiveness of current environmental policies. In principle, most environmental matters are the responsibility of the provinces, unless expressly delegated to the national government. Lack of clarity about the allocation of responsibilities between the provinces and the *Secretaría de Recursos Naturales y Ambiente y Humano* (SERNAH) of the national Government are commonplace. In addition, the ability of provincial and municipal institutions to implement their environmental responsabilites is very uneven, further complicating the picture.

1.11 *Conceptual Framework.* The excessive pollution levels in many parts of Argentina point to the need to improve and strengthen the government's strategy for the management of environmental pollution. The underlying conceptual framework is to (i) begin with a comparative analysis of the health, productivity amenity and other costs associated with the different forms of pollution as a basis for establishing relative priorities,[2] followed by (ii) an analysis of the options for addressing the problems based on the comparison of costs and benefits, and (iii) the integration of the results into a recommended plan of action. The main

1. The 1991 Convertibility Law fixed the exchange rate at a parity of one peso to the US dollar.

2. The lessons of recent sector and research reports in the Bank with regard to the dominant share of health impacts in the total social and economic cost of pollution, and the large influence of poverty-related factors on the health impact of pollution are explained in World Development Report 1992: Development and the Environment, and World Development Report 1993: Investing in Health, World Bank, Washington, 1992 and 1993, respectively.

criterion for choosing between alternative options will be that of cost-effectiveness in achieving the environmental objectives.

1.12 Pollution problems are very location-specific. Therefore, it is almost impossible to have adequate information to formally implement the conceptual framework. In addition, in Argentina, the concentration of pollution problems in the cities also mandates a more detailed consideration of the urban setting. Therefore, the development of an integrated pollution control strategy will have to consider objectives in related sectors, such as health, urban development, industry and transport, with which coordination is required. To achieve a comprehensive coverage and devote sufficient attention to these related program areas, the analytical approach of this report is necessarily pragmatic. The ideal framework is followed informally, illustrated with specific case analysis as data permits. Data limitations have not allowed full-fledged cost-benefit analysis at this time.

1.13 This report focusses on problems of environmental pollution, which are based on externalities that extend beyond the household or workplace which causes the pollution. Problems of industrial and worker safety as well as other environmental problems such as indoor air pollution (e.g. from tobacco smoking), and ecological damages are not addressed. It should also be noted that, given the lack of information and attendant difficulty in presenting fuller coverage, this report is focussed on urban pollution, and does not assess non-urban sources of pollution, such as those associated with agricultural, livestock and forestry-related activities, mining and hydropower generation. The present chapter presents an overview of pollution problems in Argentina and attempts to analyze the costs of pollution. Chapters II-V present options for addressing pollution problems, assessing their costs, and determining, where feasible the cost effective interventions. Chapter VI analyzes institutional questions and Chapter VII concludes with the definition of priorities for action.

Types and Extent of Pollution

1.14 Argentina suffers from a variety of environmental pollution problems whose severity and relative importance varies from region to region, depending on the underlying causes and social and economic dimensions. It is difficult to present a coherent panorama, mainly as a result of the scarcity of data on the physical and social dimensions of pollution. One of the consequences of privatization and decentralization over the last fifteen years has been that many efforts of data collection and surveillance of environmental quality have been abandoned. There is little monitoring of ambient water quality, and virtually none of air quality, and virtually no analysis of its health effects and other economic damages. However, in very broad terms, a dualistic pattern emerges with one cluster of pollution problems that affect the major metropolitan areas and a second cluster that prevails in smaller cities and towns, as summarized on Table 1. The major problems are discussed below.

Water Resources Contamination

1.15 *Groundwater Contamination.* Groundwater contamination is a major concern, as a large share of households (28% in the country, but 65% in the outer ring of AMBA), which is not connected to the water network, uses groundwater to meet its daily needs. A recent survey in suburban Buenos Aires (not including the Capital Federal) found that 47% of the households were connected to the public network, 23% relied on handpumps, and 24% on electrical water pumps[3]. As handpumps can only reach the Epipuelche aquifer (10-30m deep) which is thoroughly contaminated, and electrical pumps are normally designed to reach the Puelche aquifer (25-60m deep), which is contaminated in some areas, these figures indicate that a substantial share of the population in Argentina's largest city uses contaminated drinking water. A similar situation occurs in other

3. Oral information from COFAPyS.

Table 1: Two Patterns of Environmental Pollution in Argentina

Pollution Problems of Metropolitan Areas (Buenos Aires, Córdoba, Rosario and Mendoza)
- Ground and surface water pollution from untreated domestic sewage and industrial effluents (severe in small local streams) - Air and noise pollution from transport and industrial sources (severe in central locations, industrial concentrations, Mendoza and Córdoba) - Inappropriate disposal of solid wastes and industrial hazardous wastes (especially in periurban areas)
Pollution Problems of Medium and Small Cities and Towns
- Ground and surface water pollution from untreated domestic sewage and inadequate collection and disposal of solid waste - Water and air pollution from major local industries: ! petrochemical industries, lime quarries (Pampas region) ! oil production, sugar refining, lead smelters (Northwest region) ! oil fields, uranium extraction (Cuyo region) ! oil fields, coal mining (Patagonia region)

cities in the province of Buenos Aires, as well as in other provinces.

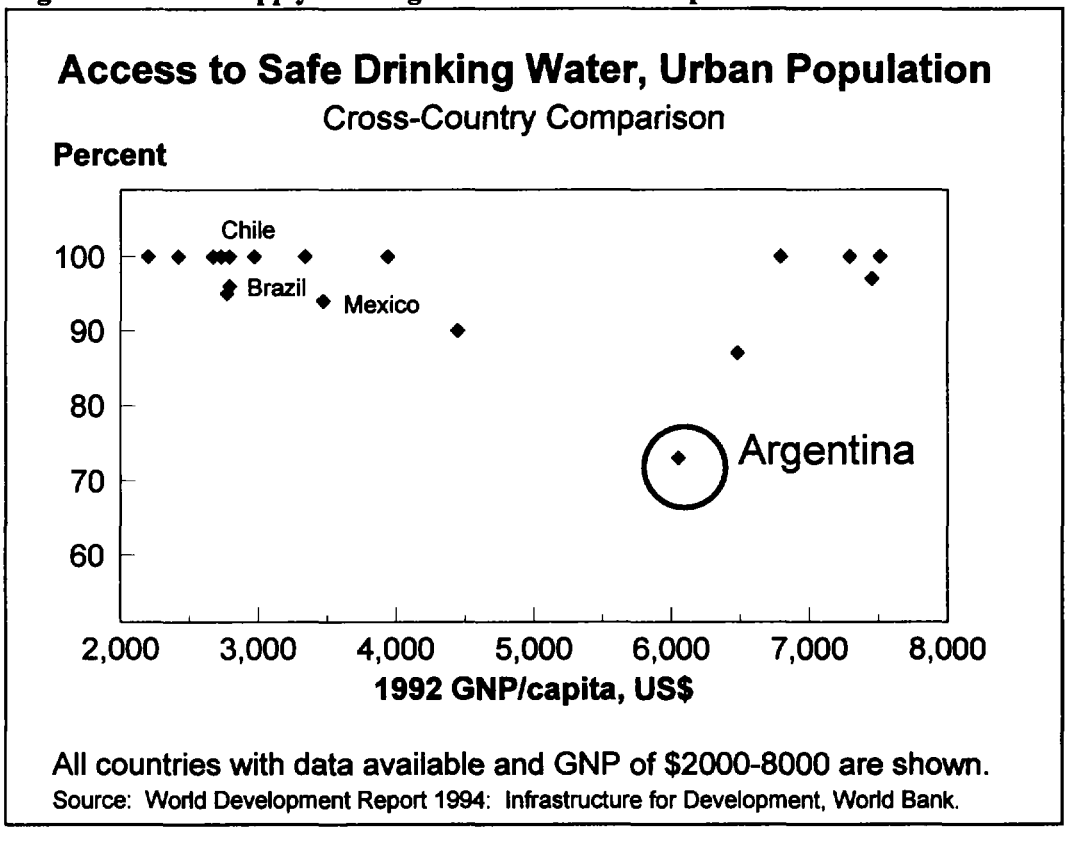
1.16 This indication is supported by a 1988 analysis of 868 domestic water samples in Gran Buenos Aires, which found that the groundwater resources are substantially polluted[4]. In six out of the 13 municipalities covered in the study, the median nitrate content reached or exceeded the allowable limit of 45 mg/l, and about 34% of the samples showed evidence of bacterial contamination. In some cases, contamination was also found in samples drawn from the public network. Although detailed information is not available, a similar situation is believed to exist in other cities, especially in areas that concentrate the poor in dense, irregular settlements which are not served by public water supplies. Mercury and chromium pollution, likely from the illegal disposal of industrial wastes in open air dumps, has also been documented in groundwater sources in the Buenos Aires area. In addition to human-caused pollution, there is also concern about natural arsenic contamination of many aquifers in the interior of the country.

1.17 The main source of groundwater contamination is believed to be the septic tanks used by households (71% in Gran Buenos Aires, 62% in the country[5]) that are not connected to

4. Ministerio de Salud y Acción Social, Secretaría de Salud, Dirección Nacional de Calidad Ambiental, "Evaluación de Nivel de Nitratos en Agua de Bebida en los Partidos del Gran Buenos Aires", Buenos Aires, 1988.

5. The unserved share is 72% in an outer ring of six municipalities that, together with the Capital Federal and the 13 municipalities in the inner ring, constitute the Area Metropolitana de Buenos Aires, based on 1991 Census. Wolrd Bank, Argentina: Water Supply and Sewerage Sector Note, Draft Report No. 12810-AR, July 27, 1994.

Figure 1: Water Supply Coverage - International Comparison



sewerage. A second major source are industrial effluents, which are also frequently disposed of in leaching pits and septic tanks. Both residential and industrial septic tanks drain into the freatic Epipuelche aquifer. Some contamination of the deeper Puelche aquifer also occurs through inadequately insulated waterwells.

1.18 The number of households that uses contaminated water may not have declined significantly since the mid 1970s, as incomplete efforts to commercialize and decentralize public services have led to the underfunding and deterioration of sanitary and waste management infrastructure, and barely enabled water supply and sewerage expansion to keep up with the growth of urban populations, but not to reduce the deficit. As a result, coverage with water and sanitation infrastructure is low for a country with Argentina's level of income, as indicated in Figure 1.

1.19 *Surface Water Contamination.* The pollution of rivers and coastal waters in and around the major urban areas of Argentina has been extensively documented.[6] *Obras Sanitarias* has estimated that 2.2 million m^3/day of raw sewage and 1.9 million m^3/day of industrial effluent flow from the AMBA the Río de la Plata.[7] At the Río de la Plata, a recent study found that ambient water quality guidelines are consistently exceeded in the 300 m wide strip nearest to the shore, rendering the local beaches unusable, but regularly met in waters farther than 3000 m from the shore. This is an indication of the enormous waste dilution and self-purification capacity of the Río de la Plata, with its flow of 30,000 m^3/sec.[8]

6. The water supply companies regularly monitor the water quality at their intakes, and sometimes upstream, but this information is not centrally collected.

7. Empresa Obras Sanitarias de la Nación, Contaminación Hídrica, undated note.

8. AGOSBA, OSN and SIHN, Río de la Plata - Calidad de las Aguas - Franja Costera Sur, 1992.

1.20 As one of the most polluted local streams, the Río Matanza-Riachuelo, receives discharges from both domestic and industrial sources (some 20,000 plants, of which nearly 2/3 do not have treatment facilities, while only 3 percent of the remaining regularly operate them). The Río Reconquista runs through 14 municipalities, receiving direct discharges from 7,500 industrial plants, and indirect discharges (through sewers and drainage pipes) from an additional 12,000 plants. Domestic discharges are also an important source of pollution. According to the *Comisión de Investigaciones Cientificas*, one third of the pollution load of the Río de la Plata comes from the Río Reconquista.

1.21 Another problem in AMBA, that has heightened concerns about surface water pollution, is the vulnerability of many newly settled areas to flooding, which is estimated to affect up to about 23% of the area. Flooding is caused by heavy rains, mostly in the summer, and southeasterly winds *(Sudestadas)*, which bring about unusually high tides in the Río de la Plata, mostly in the winter. The floodwaters pick up solid wastes from a few open air dumps, sewage and industrial effluent from streams and storage ponds, compounding the physical damage with extensive spread of contamination. The duration of the floods is extended by inadequate drainage infrastructure and the obstruction of streams by garbage and siltation.

1.22 A similar pattern of pollution is reported for other parts of the country. The Lago San Roque in Córdoba, Lago Lácar in Neuquen, and Lago Nahuel Huapi in Río Negro, are at least partially contaminated by untreated sewage from lakeshore towns, some of them to the extent of affecting the performance of the drinking water treatment plants. The Río Salí in Tucumán and some irrigation channels in Mendoza are seriously contaminated with industrial effluent. In Rosario, industrial effluent from the upstream suburbs on the Paraná river have adversely affected the operation of the main water treatment plant.

Air Pollution

1.23 Air pollution is primarily an inner city problem for drivers, pedestrians, workers, shoppers and residents who are subject to vehicle pollution. Most of the pollution in downtown areas can be attributed to vehicles and most of that in the suburbs to industrial emissions and, in some areas, the burning of garbage. In spite of a high level of urban concentration and vehicle use,

Table 2: Selected Air Pollution Measurements

Location/Pollutant	SPM (Tg/m^3)	SO_2 (Tg/m^3)	NO_x (Tg/m^3)	CO (ppm)	Pb (Tg/m^3)
Capital Federal (selected measurements in July 1993 and May 1994)	70-90	3-18	38-240	day: 7-14 even: 5-9 night:<1	0.3-3.9 (see 3)
Mendoza (selected measurements in July 1993)	30-250	0.2-5.4	0.6-5.3		
Córdoba (annual averages based on regular measurements 1988-1991)	80-192	32	41-50		
Palpala, Jujuy (average of 82 24 hr measurements in 1990)	209	46.3			22.9
US EPA Primary Standards	75 (Annual Geometric Mean)	80 (Annual Arithmetic Mean)	100 (Annual Arithmetic Mean)	9 (8-hour Average)	1.5 (Quarterly Average)

Box 1: Air Pollution Monitoring in Buenos Aires

Monitoring of air quality is scarce in Buenos Aires: at present, monitoring on a continuous basis is only done by the municipality's *Laboratorio de Vigilancia Atmosférica*, the *Fundación Siglo XXI*, which monitors exclusively CO levels, and the *Instituto Pro Buenos Aires*.

The *Laboratorio de Vigilancia Atmosférica* is the only institution with a long standing history in air quality monitoring. However, its data have never been published. One of the main reasons seems to be the tight budget under which the lab is operating, manifesting itself in a shortage of staff, computers, and outdated and partly malfunctioning equipment. The laboratory monitors (a) gaseous contaminants such as nitrogen monoxide, nitrogen dioxide and sulphur dioxide at a measuring station in Palermo on a daily basis; (b) articulate matter such as tar, carbon, ashes, inorganic particulate matter on a monthly basis at different locations in the city (due to extremely limited funds only 3 out of the 8 (mobile) stations are currently in working condition); and (c) other contaminants like lead, suspended particles, and, in periodic intervals, the total level of oxidants.

Fundación Siglo XXI started monitoring carbon monoxide levels in March 1992. Currently, it maintains three monitoring stations which measure CO levels continuously, i.e. 24 hours per day, in one minute intervals. Two of the stations are located in the port area, and, more importantly, one station was installed in 1993 in a narrow street in the *macrocentro*, at Talcahuano 469. It is envisaged to install further stations, inter alia, on the *Acceso Norte*, a main artery with extremely high traffic densities which feeds into the city center from the northern suburbs. This station will, in addition to CO and noise levels, also monitor particulate, NOx and lead emissions.

The Instituto Pro Buenos Aires maintains a mobile unit which measures, inter alia, CO and NOx levels, hydrocarbons, suspended particulate matter, and noise levels. At present, data is not available. Apparently, it is envisaged to prepare an environmental map of the city of Buenos Aires based on the data collected by the mobile unit. The institute also maintains a *Linea Verde*, a hotline for concerned citizens to report environmental violators, with a view to increasing environmental awareness among the population.

the seriousness of air pollution problems in Buenos Aires has been mitigated by a favorable wind regime. Nonetheless, the winds are not sufficient to disperse the pollution collecting in narrow, heavily travelled streets during working hours when traffic emissions accumulate to unhealthy levels. Overall, there is very little systematic information about air pollution levels and compositions. However, the potential long-term low-dose consequences are serious enough to merit further study and systematic monitoring. Some available measurements are shown in Table 2.

1.24 Mainly driven by the low cost of natural gas, Argentina's energy consumption structure is already evolving towards an increasing share of this relatively clean fuel. As of 1991, natural gas accounted for 46% of the industrial sector's energy requirements, 78% of the power sector's, and 3% of the transport sector's (in the form of CNG—compressed natural gas). The use of coal, which is more environmentally problematic, is limited to 3% of industry's requirements (for cement production) and 3% of the power sector's (with only one remaining coal fired plant—in San Nicolás, Prov. of Buenos Aires). Fuel oil is mainly used where gas is not available and by the

Table 3: Lead Pollution in Buenos Aires

Location	Sampling Period	Concentration (Tg Pb/m^3)
Downtown (High density traffic)	8AM - 5 PM	3.9
Downtown (High density traffic)	7PM - 8 AM	1.7
Downtown (Medium traffic)	24hrs.	1.5
Suburban (Medium traffic)	24hrs.	1.0
Suburban (Low traffic)	24hrs	0.3
Argentina standard		1.0

Source: Caridi, et at (1989)

power sector in the winter season, when gas is in short supply (in Buenos Aires city).

1.25 *Buenos Aires.* Air pollution data for Buenos Aires are extremely limited. Box 1 describes the ongoing efforts. Based on available data, it can be concluded that carbon monoxide (CO) concentrations regularly exceed standards during the daytime. No sufficient data are available to allow a similar judgement for sulphur dioxide (SO_2), nitrogen oxides (NO_x), or particulates. As a result of a high lead content in gasoline (0.6-1.0 g/l), selective measurements in the city center have shown concentrations up to 3.9Tg/m^3, compared to an USEPA standard of 1.5Tg/m^3 (quarterly average)[9]. The only available study[10] suggests that lead air pollution may represent a major health problem in Buenos Aires. Table 3 summarizes the study results.

1.26 *Córdoba.* Due to its being partially surrounded by mountains, the city of Córdoba suffers from a relatively serious air pollution. This has led the municipality to establish an extensive data base on air pollution by area (PROAIRE),[11] with reasonably consistent data (from 1971) on sulfur dioxide (SO_2), oxides of nitrogen (NO_x), settled particulate matter, suspended particulate matter (SPM), aldehydes, (photochemical) oxidants, and an index of corrosion. The data suggest an increase in SO_2 concentrations of nearly 400% since 1976. In 1976, SPM averaged about 40 Tg/m^3, and increased over 250% to an average of about 100 Tg/m^3 in 1994. PROAIRE also identifies pollution sources (e.g., 15 categories of motor vehicles, leaves and garbage, small and medium sized businesses, etc.).

1.27 *Global Concerns.* In addition to the local impacts of air pollution, the emissions of greenhouse gases (GHG) and (stratospheric) ozone depleting substances (mainly chlorofluorocarbons—CFCs) have a global effect. A recent estimate indicates that Argentina accounted for about 0.7% of global human-made GHG emissions in 1991.[12] Of the total (adjusted on the basis of their greenhouse forcing contribution), about 61% was attributed to energy use (mainly liquid fuels, 52%, and natural gas,

9. WHO/UNEP. Urban Air Pollution in Megacities of the World. World Health Organization, United Nations Environment Program. Blackwell, Oxford, 1992.

10. Caridi, et al., Determination of Atmospheric Lead Pollution of Automotive Origin, Atmospheric Environment 23, 1989.

11. Municipalidad de Córdoba y Raúl A. Montenegro; "PROAIRE: Programa Municipal para Reducir la Contaminación del Aire en la Ciudad de Córdoba", Primera Entrega, Agosto de 1993; Segunda Entrega, Octubre de 1993.

12. The figure for Argentina does not include an estimate of the CO2 released due to deforestation. Based on World Resources 1994-95, A Guide to the Global Environment, World Resources Institute, Oxford University, Press, New York, 1994.

41%), 28% to methane emissions (mainly livestock, 83%), and 11% to chlorofluorocarbons (CFC) use. Argentina's CFC emissions accounted for about 0.5% of global emissions of ozone depleting substances. These shares are roughly in proportion to Argentina's share of the global population (0.7%).

Hazardous Wastes

1.28 A recent study estimates that about 47,000 tons/year of hazardous wastes[13] are produced in the Province of Buenos Aires alone, mostly by the metallurgical-electronic (46%) and chemical-petrochemical (44%) industries[14]. It is illegal to dispose of these wastes in the sewers or sanitary landfills. Since no specialized commercial facilities for the treatment or safe disposal of hazardous wastes exist in AMBA, there is great uncertainty about how these wastes are being disposed of. Certainly some are being deposited into open air dumps and pits that leach into the aquifers, as the analysis of groundwater at various locations in the Province has detected the presence of heavy metals, hydrocarbons, and other hazardous substances. A major part is dumped into local rivers, such as the Matanza-Riachuelo and the Reconquista, where they accumulate in the muddy bottoms or flow into the Río de la Plata.

1.29 Overall, the social and economic cost of inadequate hazardous waste disposal is related to the aggravation of the ground and surface water contamination problems already discussed above. There have also been instances where the settlement of areas previously used to dump hazardous waste, and the disposal of hazardous wastes in unmanaged open air dumps, has led to heavy metal contamination in children. Due to political sensitivities and the long lag between cause and effect in toxicological health impacts, these cases have been difficult to document.

Solid Waste

1.30 In most parts of the country, solid waste is collected by municipal contractors, and deposited in open-air dumps, where some of it is burned. Local concerns focus on the coverage of collection, which is inadequate in the irregular settlements which concentrate the poorer population. In the absence of collection, garbage piles up in empty lots and local streams, where they constitute a source of water contamination, and to a lesser extent, a breeding ground for disease vectors.

1.31 The open air dumps raise concerns due to their inadequate location, design and operation. Specific problems relate to their inadequate buffering from inhabited areas (mostly irregular settlements), their accessibility to scavengers and children, their location in low areas subject to flooding, and their contamination of groundwater. A recent study has revealed that contamination from solid waste dumps has reached the upper aquifers on which the population unserved by public water supplies depends for its water.[15] The social and economic costs associated with inadequate solid waste disposal relate to their health effects and impact on the amenity value of surrounding areas. Overall, while the problem is well understood, it is not being monitored or studied systematically.

Noise Problems

1.32 Noise pollution is caused primarily by heavy, congested traffic. It is a major problem in the downtown area of larger cities and along major traffic arteries. Loss of hearing is the most severe health consequence of noise pollution, followed by minor hearing problems, sleep disturbances and stress. Excessive noise levels can lead to significant losses in property values

13. Hazardous wastes are defined as those that have one or more of the following characteristics: ability to poison humans or other life forms, flammability, corrosivity, reactivity or capability to produce a hazardous leachate.

14. Dames & Moore, Estudio de Factibilidad - Residuos Peligrosos - Provincia de Buenos Aires, Buenos Aires, 1992.

15. Lopez, Alicia Cristina. "Los desechos sólidos y su incidencia en las aguas subterraneas"; Seg. Jorn. Geol. Bon., Bahia Blanca, 1988, ACTAS.

and the need for defensive expenditures (e.g., improved insulation). Measurements in Rosario have determined noise levels of 100dB at peak hours, well above the WHO-recommended standard of 80 dB. 20,000 to 50,000 people in this city of 600,000 are estimated to be exposed to noise levels that pose a serious risk to hearing.[16] According to a study conducted by the Instituto Pro Buenos Aires, noise levels exceed WHO standards in most parts of the city; only two out of Buenos Aires' 46 neighborhoods—Villa Pueyrredon and Versailles—are in compliance with the standards. Another study concluded that buses and trucks, i.e. diesel engines, are the main source of noise pollution.[17]

The Effects of Pollution on Health

1.33 The costs associated with environmental pollution include health damages, productivity losses, and the loss of amenity values such as nature-based recreation and preservation of natural ecosystems. As health-related damages are widely recognized to be the most important in developing countries, they will be discussed first.

Indications from the Health Data

1.34 The severity of health problems attributable to environmental pollution in Argentina is difficult to determine, as almost none of the potential health damages have so far been documented through studies directly linking pollution to actual cases of disease or death. Numerous studies establish the existence of pollution of all sorts, ranging from extremely toxic industrial byproducts to domestic fecal contamination, yet very few of these studies analyze the effects of pollution on the health of the local population.

1.35 At present four types of health data are available in Argentina that can be used to analyze health problems at an aggregate level: (i) a countrywide register of mortality by cause of death. These data are judged to have complete coverage; (ii) an epidemiological surveillance system that includes primarily infections/communicable transmittable diseases. Reporting in this system is known to be incomplete; (iii) data on admissions to public hospital is available by cause. This provides a reliable, but incomplete, source for morbidity data from public health centers and hospitals, which serve over half the population; and (iv) incomplete data is available from 13 regional toxicology centers.

1.36 The low quality, inconsistency, and incompleteness of most of the data sources is widely acknowledged. For example, local health personnel have indicated that the available health data are likely to mask factors that could be directly linked to pollution. Physicians, e.g., frequently use a "default" category such as heart failure for diagnosing the immediate cause of death, without recording contributing causes such cancer or pesticide poisoning. Also, physicians have not been trained to diagnose and record secondary and tertiary causes of death, e.g., chronic respiratory diseases from long-term exposure to pollution, lead poisoning, or exposure to toxic waste. Thus, the fact that environment-related diagnoses do not show up in the data is not sufficient to establish that such problems do not exist.

1.37 Based on mortality data, the health problems of Argentina are more typical of an industrialized country than of a developing country, with diseases of the circulatory system as the leading cause of death. The top five causes of death in 1992 consisted of heart disease (31%), cancers (18%), cardiovascular disease (10%), accidents (4%), and perinatal illnesses (3%).[18] In 1990, the main causes of hospital admissions accounting for over 5% or more of the total visits were childbirth (18.56%), obstetric problems

16. Municipalidad de Rosario and Fundación Banco Municipal de Rosario, Condiciones Ambientales y Salud en la Ciudad de Rosario, 1994. p 40

17. Instituto de Seguridad y Educación Vial (ISEV) and Xilix, S.A.

18. Estadísticas Vitales, 1992, Ministerio de Salud y Acción Social, Buenos Aires, 1992.

(8.98%), accidents (7.8%), and circulatory problems (6.7%). By and large, the public is well fed and decently housed.

1.38 At the aggregate level, health statistics offer little evidence of systematic pollution-related damages to human health apart from diarrheas due to fecal contaminants and perhaps pneumonia due to indoor air pollution. On the other hand, conversations with health personnel and closer data examination reveal a different picture that shows the persistence of the traditional diseases of poverty, especially in urban slum areas and pockets of rural poverty. Pollution related diseases are widespread within pockets, especially in the poorer areas of AMBA and the poorer provinces of the North. The main pollution-related health problems of national significance are: diarrheas, primarily from poor water and sanitation and respiratory tract infections from indoor/outdoor air pollution.

1.39 The consensus of professional judgement seems to suggest that environmental health problems are widespread, but highly concentrated among the poor. A biologist working with populations exposed to solid waste and water pollution near a landfill/dump felt that the two most important problems were parasitic infections and malnutrition of the very young, caused by exposure to the waste and contaminated drinking water. A physician from Florencio Varela, a low-income municipality within AMBA, described respiratory illnesses, diarrheas and circulatory problems as the main problems. Physicians from a children's hospital in La Plata cited undernutrition, malnutrition, and infectious diseases as most important.

1.40 The persistence of the diseases of poverty, some of which are environment-related, in an upper-middle income country is also highlighted by the data of the epidemiological surveillance system of communicable diseases. Gastrointestinal problems are the most important (53%), followed by respiratory problems (39%), declining to sexually transmitted and other causes (4% each). The disease patterns for children under five were also typical of a developing country. In 1990, the top five causes of hospital admissions were neonatal infections, intestinal infections, pneumonia, bronchitis and other respiratory infections, and congenital abnormalities.[19]

1.41 The above pattern appears to be a nationwide problem associated with deficiencies in water supply and sanitation and the persistence of poverty. Other environment-related health problems tend to be regionalised and more episodic rather than long-term. Among the localized pollution problems with health consequences are arsenic poisoning in central and northern regions; Chagas' disease[20]; contamination by toxic substances such as hazardous wastes and pesticides, and a few cases of malaria and schistosomiasis[21]. The consequences of ozone depletion, most notably skin cancer and cataracts, also present a potential problem, especially in southernmost Patagonia, which is touched by the "ozone hole". In addition to the typical environment-related health problems, some occupational health problems are so widespread that they become public health problems, since many of the medium and small sized industries have not yet adopted adequate health and safety practices.

1.42 *Environmental mapping.* The analysis of local environmental conditions and local health data has proven more productive in detecting linkages than the analysis of aggregate data. At least two groups have been working an environmental mapping. The IIED-LA[22] has

19. Boletín Epidemiológico Nacional, Anual 1993, Ministerio de Salud y Acción Social, Buenos Aires, 1993.

20. Chagas' disease, also called South American sleeping sickness, is a debilitating disease spread by a blood-sucking insect, the cone-nose bug. The disease is directly linked to poor rural housing conditions, since the insect lives in cracked walls and roofing common in poor areas.

21. Schistosomiasis is an infection of the bladder, intestines or liver by a parasitic worm. The disease is spread by an aquatic "flea" which either penetrates the skin or is swallowed.

22. Instituto Internacional de Medio Ambiente y Desarrollo (International Institute for Environment and Development - Latin America, IIED-LA)

Table 4: Morbidity and Mortality from Diseases Associated with Water and Sanitation

Disease	Mortality (1992)	Recorded Morbidity (1993)	Assumed Morbidity (1993)
Typhoid/Paratyphoid	4	259	518
Diarrheic Diseases	766	485,558	966,956

Sources: Staff estimates based on Estadisticas Vitales, op. cit, and Boletín Epidemiológico Nacional, Anual '93, op. cit.

developed maps of neighborhoods in Buenos Aires based on their environmental conditions, such as propensity to flooding, proximity to pollution, etc. The *Banco Municipal de Rosario* has financed the preparation of a series of studies in Rosario including a mapping, dividing up the city in 21 areas, with indications of the location of *villas miserias*.[23] For every area, 19 indicators of health and infrastructure are provided, some numerical, some descriptive. The analysis reveals a clear pattern confirming that morbidity and mortality rates are highest where basic services are lowest. Diarrhea is the top notifiable disease and its incidence is directly correlated with lack of water and poor living conditions. The various background studies and maps provide a ready-made tool for looking more closely at environmental health, such as in determining potential exposure to solid waste, industrial pollution, etc.

Health Effects of Water Contamination and Poverty

1.43 Despite overall modest levels of intestinal disease, water pollution ranks as the most severe environmental health problem. The most apparent toll appears to be in diarrheas of children. Given the limitations of available data and the existence of confounding factors, there are many hurdles to establishing strong quantitative links between water pollution and health damages. The lack of sanitation and access to safe water and the extensive reliance on contaminated groundwater water is only one of several factors contributing to disease. Moreover, lack of basic infrastructure is often more prevalent in areas where other factors contributing to disease are equally present such as poor hygiene, low education, and low income. Table 4 summarizes the incidence of morbidity and mortality from water-related diseases. As noted before, the morbidity data of the epidemiological vigilance system is grossly underestimating actual rates of disease. In line with the estimates of health professionals and other sources, the following analysis is based on the assumption that the morbidity data only covers 50% of actual cases. The diarrhea rate would then be 2,800 per population of 100,000.[24]

1.44 The magnitude of health benefits of increasing sanitation infrastructure can be obtained from the international literature. A review of studies done in various countries[25] determines that median reduction in diarrhea morbidity is 27% and reduction in diarrhea mortality is 41% subsequent to the introduction of sanitation infrastructure. Applying these

23. Municipalidad de Rosario and Fundación Banco Municipal de Rosario, "Condiciones Ambientales y Salud en la Ciudad de Rosario, Febrero de 1994.

24. Asociación Argentina de Ingeneria Sanitaria y Ciencias del Ambiente, "Resumenes Sectoriales de Abastecimiento de Agua Potable y del Saneamiento en la República Argentina", Ingeniería Sanitaria y Ambiental. This assumption is in line with the assessment of national health professionals and other estimates of a diarrhea rate for 1992 of 2,880 per 100,000, 14, April 1994, page 22-24.

25. Esrey, S.A., R.G. Feachem, and J.M. Hughes, 1985, "Intervention for the Control of Diarrhoeal Diseases among Young Children: Improving Water Supplies and Excrete Disposal Facilities" in: Bulletin of the World Health Organization, 63(4), pages 757-772. Based on the median of all studies, diarrhea morbidity is reduced by 22% with interventions. Based on the median of the better design studies, diarrhea morbidity is reduced by 27%. Based on the median of all studies that analyze mortality, diarrhea mortality is reduced by 41% and total mortality by 21% with interventions.

Box 2: The Evaluation of Morbidity and Mortality

Two approaches have commonly been used to value the mortality and morbidity resulting from exposure to pollution: the willingness to pay (WTP) and the cost of illness/human capital approach.

Mortality. The **willingness to pay approach** for valuing a statistical life is the theoretically preferred one. Studies carried out in the U.S. and U.K. evaluated the implicit WTP expressed as wage premiums associated with on-the-job risks and surveyed the explicit WTP for avoiding such risks. These studies conclude that most of the reasonable estimates of the WTP to avoid a mortality risk increment of 0.0001 are clustered in the range of US$200 to US$500 per year*. In the absence Argentine estimates, and in order to establish orders of magnitude for discussion purposes, we can adjust United States estimates by the GDP ratios of the two countries (3.4 in 1992), giving a value of A$59 to A$147 as the WTP for a mortality risk reduction of 0.0001. Thus, if each person is willing to pay A$59 for the 10^{-5} risk reduction, then the value of a statistical life is A$590,000. The **Human capital approaches** to valuing mortality yield much lower estimates since they include only lost productivity and not the pain, suffering, and emotional distress. The human capital approach is useful to calculate a lower bound for the cost of a case of mortality. This approach estimates how many years of work are being lost with a premature death, and evaluate the productivity loss. In Argentina, using an average of 12 work years lost to premature mortality and a discount rate of 5 percent would give a value of A$ 64,000 per life.

Morbidity. Treatment costs per diarrhea case are in the order of A$30. Assuming a wage rate of A$20 per day and three workdays lost per diarrhea case, the economic costs of one diarrhea case are about A$90. This approach neglects the cost of the discomfort associated with the disease.

Of course, these figures are not to be regarded as accurate estimates, but only as illustrative figures to further the discussion of environmental costs.

*Source: Cropper, M.L., and Oates, W., Environmental Economics: A Survey, in Journal of Economic Literature, 30, pp.675-740, 1992. See also Viscusi, W.K, Fatal Tradeoffs: Public and Private Responsibilities for Risk, Oxford University Press, New York, 1992.

factors to the urban and rural population of Argentina and the diarrhea estimate of 2,800 per 100,000, it can be concluded that water connection to one additional person reduces diarrhea morbidity by 0.009 cases per year and mortality by 0.000013 cases.[26] These figures would suggest that the incomplete coverage with water systems causes 77,541 episodes of diarrhea, and 111 deaths per year.

1.45 The calculation of health benefits from international data can be verified in selected cases where data are available in Argentina. The best data set was encountered in the Province of Jujuy, which has established a system of primary health care attention (*Atencion Primaria de la Salud)* that allows the analysis of the effect of different type of water and sewage service on the incidence of diarrhea (see Box 2). Data from other parts of the country provide qualitative confirmation of the quantitative results of the analysis in Jujuy. Similar data at a more aggregated level are available in the municipality of Florencio Varela (AMBA), the city of Rosario (Santa Fe), and possibly other locations. Casual evidence supports the view of water-borne diseases as the main environmental health problem. In a *barrio* within Florencio Varela, a

26. Morbidity benefits are obtained by solving the equation x+8,268,000 + (x+0.73)+21,066,000 = d+29,334,000 (where d=0.028 is the observed country wide diarrhea rate and x is the diarrhea rate inferred for the uncovered population) for x and multiplying x with 0.27, the reduction in morbidity as the result of sanitation improvements. Similarly, mortality benefits are obtained by solving y+8,268,000 + (y+0.59)+21,066,000 = m+29,334,000 (where m=0.000023 is the observed country wide diarrhea mortality rate and y is the diarrhea mortality rate inferred for the uncovered population) for y and multiplying with 0.41.

Figure 2: Diarrhea and Water Supply in Jujuy

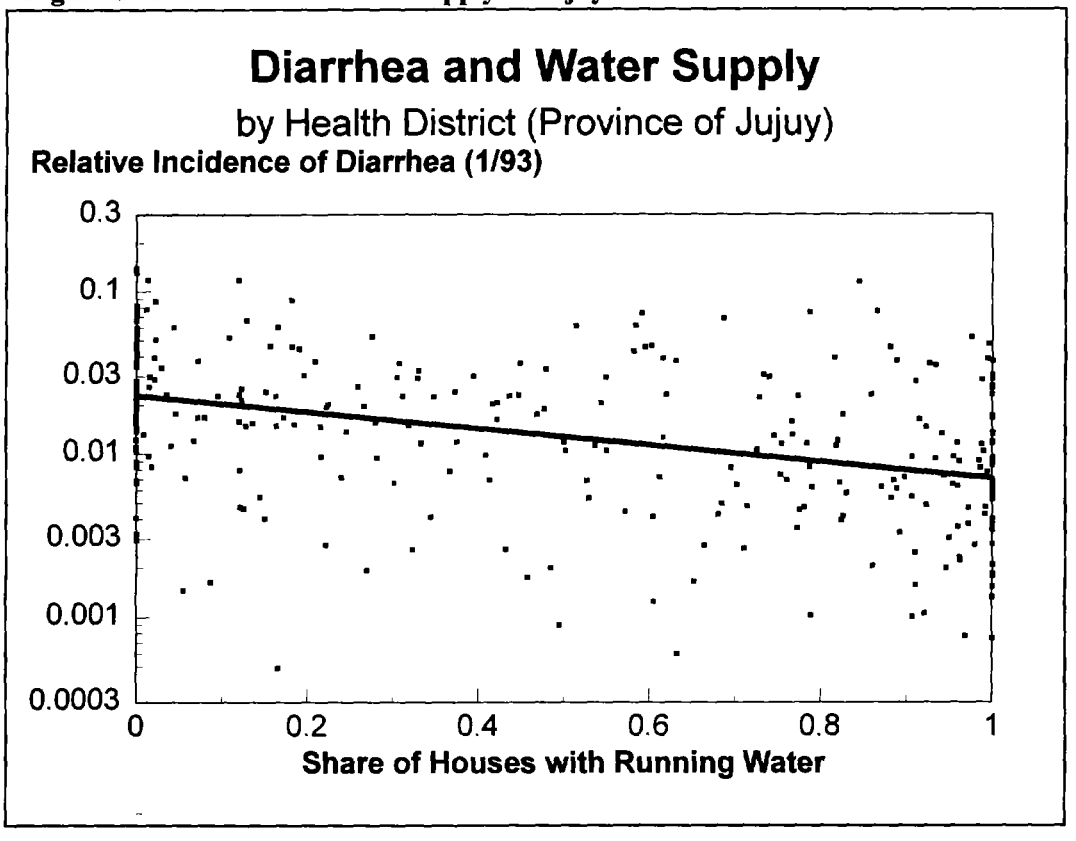


Table 5: Comparison of International and Jujuy Data

	Diarrhea Morbidity	Diarrhea Mortality
	Reduced Cases with One additional Person Covered with Water and Sewerage Services (and associated economic benefit)	
International Data	0.009 ($0.81)	0.000013 ($0.83-7.67)
Jujuy Data	0.05 ($4.50)	0.00004 ($2.56-23.60)

power outage occurred during the evening and was followed the next day by about 2,500 cases of diarrhea (shigellosis), directly attributable to backflow in the water pipes which drew in contaminated water.

1.46 Table 5 summarizes the comparison of data from the international literature applied to Argentina and data from the analysis of the Jujuy database. Using the evaluation methods described in Box 3, the annual economic cost of morbidity and mortality per person not covered with infrastructure can be calculated as $1.64 or $8.48 (depending on the method used to value a statistical life) from international data and $7.06 or $23.60 from Jujuy data.[27] Countrywide, the economic cost of lacking water infrastructure would be of the order of $7.0 million for morbidity and $7.1 or $65.5 million for mortality. The wide range of the latter estimate is associated

27. It should be noted that these estimates of the environmental benefit of water supply and sanitation are only a fraction of the total benefits, that can be estimated based on the willingness to pay for water supply and sanitation, as discussed in paras 2.17 ff.

Box 3: Water Supply and Diarrhea in Jujuy

Data are available at the level of health districts (secciones de trabajo) which include on average about 600 people. Available data for each health district include the number of houses with different type of water, sewerage, and waste disposal systems, as well as the incidence of diarrhea. Some indicators of socio-economic level of families are also available. The primary health system covers a population of about 300,000. In 1993, the system recorded 9,372 cases of diarrhea (3,145 per 100,000). Among the population covered by the system, the coverage with running water is 63.4 percent, and coverage with sewage collection is 21.0 percent while coverage with sewage collection or some other type of sewage disposal system is 72.2 percent.

Each dot in 1 shows one health district, with its diarrhea rate as a function of the share of houses receiving running water. Regressions of diarrhea rates on the share of houses served by running water, sewage collection systems, and the share of "critical families" in the district (as a measure of socio-economic level) were run. The best fit was achieved with a linear model explaining diarrhea rates only with running water. As an order of magnitude estimate, the regression analysis of the Jujuy data shows that for every additional person supplied with running water 0.05 annual cases of diarrhea would be avoided. The regression results suggest that with full coverage of water systems 5,490 annual diarrhea cases could be avoided.

The Jujuy database does not cover mortality. However, the following extrapolation can be made: Countrywide, there is one diarrhea death for every 1,275 cases of diarrhea. Assuming that every case of diarrhea leads to death with a probability of 1/1275, an additional person served with water would lead to a reduction of annual mortality by 0.00004.

with different approaches to the valuation of mortality.

Respiratory Diseases and Urban Air Pollution

1.47 Epidemiological studies in many cities all over the world have established linkages between air pollution and different health effects. Suspended particulate matter (SPM), especially the more respirable particles smaller than 10 microns in diameter (PM_{10}), causes a variety of problems including increased incidence of respiratory disease, aggravation of existing respiratory diseases, such as bronchitis, reduced resistance to infection and reductions in lung function. Studies have concluded that airborne particulate matter can cause premature mortality, particularly in elderly and ill persons, and those with a propensity for respiratory infections, such as asthma. Particulate matter also causes various lesser effects such as irritation of the eyes and throat. Exposure to sulphur dioxide (SO_2) can affect lung function, the incidence of respiratory symptoms and diseas(NO_2) on respiratory symptoms is more uncertain. Yet, NO_2 is one of the precursors of groundes and risk of mortality. Epidemiological evidence for a direct effect of nitrogen dioxide level ozone, which is the primary component of photochemical smog and a known cause of respiratory symptoms, asthma exacerbation, and eye irritations.

1.48 To date, little systematic air pollution monitoring has been conducted to allow for any decision making based on sound public health or scientific grounds. Since the database for determining the exposure of the population to air pollution is extremely weak, it is almost impossible to determine the share of respiratory diseases that can be attributed to air pollution. Similarly, without using a dispersion model it is extremely difficult to determine the effects of interventions, i.e. pollution abatement investments, on exposure, and therefore, health outcomes. Therefore it is only attempted to determine an order of magnitude range for the

Box 4 The Application of Dose-Response Functions to PM_{10} Reductions in Buenos Aires

As an illustration of how the health damages associated with air pollution by particulate matter could be estimated, if appropriate data were available for Argentina, we can use the following dose-response functions obtained from the international literature*:

(1) Change in Mortality = 0.00096 x change in PM_{10}(in Tg/m^3) x crude mortality rate x exposed population.
(2) Change in respiratory hospital admissions (RHA) per 100,000 = 1.2 x change in PM_{10}.
(3) Change in emergency room visits (ERV) per 100,000 = 23.54 x annual change in PM_{10}.
(4) Change in restricted activity days (RAD) per person per year = 0.0575 x change in PM_{10} (RAD include days spent in bed, days missed from work, and other days when activities are significantly restricted because of illness).
(5) Change in bronchitis in children = 0.00169 x change in PM_{10}.
(6) Change in asthma attacks = 0.0326 x change in PM_{10}.
(7) Change in chronic bronchitis = 0.0000612 x change in PM_{10}.

Mortality. To illustrate the application of the dose-relationship for the case of AMBA, with a population of 10.9 million and a crude mortality rate of 12.5 per 1,000 people, we have arbitrarily postulated (on the basis of Table 1), that about 10% of the population is regularly exposed to excessive levels of PM_{10} pollution. Using equation (1) above would give a figure of 65 lives saved associated with a reduction of 5 Tg/m^3 of PM_{10}. The monetary benefits would depend on estimating the value of a statistical life. Using $64,000 (as per the human capital approach) and $590,000 (as per the WTP approach) per life saved as a (see 2) and multiplying by the expected number of lives saved (65) would give a benefit of $4.2 or $38.4 million annually associated with a 5 Tg/m^3 decrease in the concentration of PM_{10}in the air.

Morbidity. Of the various effects identified, the only significant in monetary terms was the change in RAD, which gives a figure of 0.3 million days. We valued each day by half of the average daily wage ($20 per day), since not all RADs result in work loss days. The total value is thus estimated at $3.0 million annually. As to the other effects, their overall value was below $1 million each.

Overall, the total estimated benefits of reducing the concentration of PM10 in Buenos Aires by 5 Tg/m^3 would be in the order of $7.2 million or $41.4 million annually (depending on the method used to value a statistical life), assuming that the current levels of pollution are above 40 Tg/m^3 (of PM10, or 80 Tg/m^3 of total suspended particles). Of course, in the absence of adequate data, these results incorporate a number of hypothetical assumptions are highly tentative and are simply shown here to illustrate the possible magnitude of pollution abatement benefits, and the importance of obtaining more accurate estimates to inform improved policy decisions.

*Source: Ostro, B., Estimating the Health Effects of Air Pollutants - A Method with an Application to Jakarta, Policy Research Working Paper 1301, World Bank, 1994.

health effect of air pollution in Argentina. The basic approach applied is the use of dose response functions from the economic and epidemiological literature. Dose-response functions indicate the change of health variables as the result of changes in air pollution.[28]

1.49 *Buenos Aires.* According to the *Dirección General de Política y Control Ambiental*, of the municipality of Buenos Aires, the annual averages of NO_x and SO_2 at the single monitoring station have been below the standards established by the *Código de Prevención de la Contaminación Ambiental, Ordenanza* 39025. Particulate data are not available. Therefore, a reasonable assessment of the costs associated with particulate matter can be only be carried out on a very preliminary basis. As a matter of illustration of possible health benefits associated with a reduction in particulate pollution, dose-

28. The literature on dose-response functions was recently reviewed by Bart Ostro, 1994, Estimating the Health Effects of Air Pollution, WB Policy research Working Paper No. 1301. The dose-response functions reviewed rely on results observed in cities where the concentration levels of most pollutant levels are higher than in Argentina, cautioning against uncritical application of these functions to Argentina.

Box 5: Evaluation of Damages from Lead Pollution

For illustrative purposes, in order to establish an order of magnitude for the costs associated with lead pollution, we used the following dose-response relationships showing the annualized effects of a 1Tg/m^3 change in ambient air lead levels, between 0.5-1.5Tg/m^3 (from Ostro, 1994).

(1) hypertension: 7,260 cases/100,000 adult males.
(2) coronary disease: 34.0 cases/100,000 adult males.
(3) premature mortality: 35.0 cases/100,000 adult males.
(4) IQ decrement: 9,750 points/100,000 children.

Here again, we have arbitrarily postulated (on the basis of Table 3) that, while about a third of the population of AMBA is at risk of exposure by proximity to lead-contaminated traffic fumes, up to 10% is exposed with sufficient regularity to lead to excessive blood lead concentrations (i.e., above 10Tg/deciliter). Thus, considering that about 70.6% of the population is adult and 49% is male, a 1 Tg/m^3 reduction in ambient lead, would lead to the avoidance of the following health impacts every year: 27,375 cases of hypertension; 128 non-fatal heart attacks; 132 cases of fatal heart attacks; and 31,200 IQ points lost. To value monetarily each of these effects, Argentine medical costs are assumed to be one-fifth of US costs. The associated benefits would be: (a) hypertension: $ 2.4 million (valuing each case in Argentina @ $ 88.4); (b) coronary heart disease: $ 0.7 million (@ $ 5,667/case); (c) deaths: $ 8.4-77.9 million (valuing each statistical life, as per Box 1, @ $ 64,000 and $590,000, respectively); and IQ loss points $ 42.1 million. Valuation of the cost of 1 IQ point of a child is based on productivity losses. In the US it has been estimated that, on average, the loss of one IQ point results in lost lifetime earnings of US$4,588 per child*. Adjusting this figure to Argentine average wages results in an expected loss of earnings of $1,349 per IQ point. Altogether, the total estimated benefits of reducing the lead concentration in the air by 1 Tg/m^3 which, according to the existing data may be a desirable target in Buenos Aires, are in the order of $ 53.6 or $123.1 million (depending on the method used to value a statistical life). While these results are based on numerous hypothetical and debatable assumptions, and thus can only be regarded as illustrative, we hope that they will lead to discussion and further initiatives that will help to prepare more accurate estimates.

*Source: Strategic Plan for the Elimination of Childhood Lead Poisoning, Center for Disease Control, U.S. Department of Health and Human Services, Atlanta, 1991.

response function are applied to a hypothetical reduction of PM_{10} concentration by 5 Tg/m^3.[29] Box 4 shows the health benefits associated with this reduction of particulate matter in the air. If SPM concentration was 10 Tg/m^3 above the standard in areas inhabited by 10% of the population, and PM_{10} was 50 percent of total suspended particles,[30] this would equal the cost of current particulate pollution in Buenos Aires.

1.50 *Córdoba.* The city of Córdoba maintains an extensive data base on air pollution by city

29. Assuming that current PM-10 concentrations are higher than the applicable standard (most dose-response curves assume that health effects are negligible if the concentration of the pollutant is below the standard).

30. Dr. Tafuri, Department of Chemistry, Universidad de Buenos Aires, personal communication.

area.[31] The data base also contains information on four respiratory ailments related to air pollution, i.e., acute bronchitis, asthma, chronic bronchitis and emphysema. Thus, e.g., 1976 data on 30,000 patients less than 18 years old indicate that 10% of illnesses corresponded to the four respiratory ailments: 78% were acute bronchitis, 18% asthma, 3% chronic bronchitis, and under 1% emphysema, with maximum values in June, July and August. While gaps in the data do not permit a statistical estimate of the linkage between air pollution and respiratory disease, the data show that a during a five-day smog episode in 1971, during which SPM values averaged 100 Tg/m^3 (with a peak at $300Tg/m^3$), coincided with an increase in hospital visits for respiratory ailments from an average of 200 per week to 453.

Lead Pollution

1.51 Lead in air has been shown to have a strong correlation with blood lead levels, which are associated with neurological damage in children and with high blood pressure in adults. Lead at even low doses is associated with lower IQ scores, impaired attention, speech and language deficits and behavior disorders. These deficits are significant since they may have long-term effects on childrens' educational attainment and employability. In addition, several studies indicate that at high concentrations lead may be carcinogenic. Because children inhale a proportionally higher daily volume of air per weight measure than adults, they are more susceptible to lead in ambient air.[32] Even though systematic data from Buenos Aires are not available, indicative damages from lead pollution are calculated in Box 5.

1.52 An excessive level of lead contamination has been documented in connection with several lead smelters in Jujuy.[33] In 59 percent of children in Abra Pampa, Jujuy, a blood lead content of 15 microgram per deciliter was exceeded.[34] Levels above 25 micrograms per deciliter call for medical investigation and were exceeded in 20 percent of children. Soil samples showed average lead concentrations of 3,800 ppm near the smelter and around 50 ppm in more than 1 kilometer distance. The inference drawn from the data is that children ingest lead rather than breathe it. While the latter has not been confirmed by empirical laboratory tests, additional research is being prepared on how to promote dietary change within a poor population since it is possible to counter some of the damage done by lead through diet change.[35]

Other Effects of Pollution on Health

1.53 The statistics of the poison control centers are highly incomplete. In some years, only 4 centers out of 13 have reported. Most of these reports refer to accidental poisoning. It is difficult to infer long term effects from these statistics, e.g., of exposure to toxic pollution on the incidence of cancer. There are several studies of localized toxic pollution problems. Recently, a study by the Environment Secretariat of Río Negro Province showed alarmingly high birth defects; however statistics are insufficient to determine causal link to environmental factors, such as arsenic in drinking water.

1.54 *Indoor Air Pollution.* The only evidence of indoor air pollution problems emerges from an incident in Pilar (Province of Buenos Aires) where, in response to parents' concern about the

31. Municipalidad de Córdoba y Raúl A. Montenegro; "PROAIRE: Programa Municipal para Reducir la Contaminación del Aire en la Ciudad de Córdoba", Primera Entrega, Agosto de 1993; Segunda Entrega, Octubre de 1993.

32. Margulis, Sergio, "Back-of-the-Envelope Estimates of Environmental Damage Costs in Mexico", WB Policy Research Paper, No. 824, 1992. Barrie, D., "Environmental Protection in Federal States: Interjurisdictional Cooperation in Canada and Australia", Australian National University, Federalism Research Center, Working Paper No. 18, 1992.

33. Canelada, Adrián, et.al., "Investigación Epidemiológica sobre Contaminación por Plomo en la Localidad de Abra Pampa, en Relación con una Fundición de Plomo Ubicada en esa Ciudad", unpublished paper, 1986.

34. This is the "lowest adverse effect level" according to the Center for Disease Control in the US.

35. Maria Teresita Monchietti de Maidana, Sara Cledi Assef, and Silvia Firson de Costas; "Intervención educativo sanitaria para disminuir la absorción de plomo en la población expuesta a la contaminación ambiental", undated mimeo.

incidence of respiratory ailments which were three times higher in Pilar than other areas, a closer examination of air pollution was requested. Physicians had diagnosed their respiratory illnesses as a result of cold weather and dampness. A closer epidemiological examination revealed, however, that the main factor was irritation to the respiratory tract caused by household heating and cooking fuels. Specifically, CO paralyzes the *cilia* ("hairs") lining the respiratory tract, compromising their ability to filter pathogens before they make their way to the lungs. More analysis would be required to determine how widespread the problem is and the degree of exposure to other indoor air pollutants.

1.55 *Arsenic* occurs naturally in the central and northern parts of the country, where it has been estimated that about 800,000 people are exposed to elevated levels of arsenic in drinking water.[36] However, the population is aware of is occurrence and takes preventive measures, thus avoiding major health damage. Nevertheless, given the propensity of arsenic to cause serious diseases,[37] it would be worth further analysis, and selected monitoring, to confirm that the problem is indeed minor and manageable. This health analysis would have important repercussions for provision of water supply, particularly treatment and transportation costs.

1.56 *Nitrate.* The extensive contamination of groundwater by nitrates from septic tanks, livestock pollution and fertilizer runoff is a major concern, as it can lead to methemoglobinemia, a life-threatening condition for babies.[38] Drinking water and breast milk are considered the main source of exposure.[39] In Rosario, it is estimated that 32% of the population draws water from wells contaminated with nitrates. (In addition to groundwater, about 20% of bottled waters in GBA exceeded recommended nitrate limits.)[40] However, as the existing data collection systems do not specify methemoglobinemia as a separate category, it is not possible to evaluate the magnitude of the problem, if any. According to local public health officials, another complicating factor is that methemoglobinemia tends to be misdiagnosed, thus understating its potential as a public health problem.

1.57 *Pesticides.* Given the high amounts of pesticide use in food production, it is conceivable that food chain contamination poses a long-term hazard. In a toxicology service run by the Hospital de Niños in La Plata, pesticides account for about 25% of total poisonings treated in the hospital. Physicians do feel, however, that the number of cases coming to the hospital for treatment represents only about 10-15% of the total poisonings, with the bulk using home remedies. Part of this uncertainty stems from the fact that only one laboratory in the chain of 13 country-wide toxicology centers has the capacity to do the necessary types of diagnostic blood tests. The possibility of breast cancer from exposure to pesticides in women engaged in agriculture should also be explored, based on similar occurrences in Mexico.

The Non-Health Costs of Pollution

1.58 This section discusses different categories of non-health pollution damages

36. Estimates of population surpassing the 0.01 mg/l of arsenic in drinking water are: Salta, 5,000; Tucuman, 200,000; La Pampa, 177,386; Santa Fe, 325,000; Chaco, 100,000, totalling 870,386. Source: Centro Panamericano de Ecologia Humana y Salud, "Informacion sobre poblacion general expuesta a arsenico a traves del agua y del aire, Argentina", no date.

37. Different studies have linked a variety of diseases to a high intake of arsenic in drinking water, among them bronchitis, tonsillitis, intestinal colic, arsenic melanosis, arsenic keratosis and an increased rate of stillbirths. Arsenic can also be ingested through eating food that is contaminated with arsenic residues from irrigation water.

38. Methemoglobinemia is a form of chemical asphyxiation wherein the oxygen carrying capacity of the blood is blocked by metabolites of nitrate which bind to methemoglobin instead of hemoglobin in the red blood cells.

39. The effects of nitrates can be offset by boiling water in aluminum pots and giving vitamin C supplements.

40. Dirección Nacional de Calidad Ambiental, Secretaría de Salud, Ministerio de Salud y Acción Social; "Evaluacion de Nivel de Nitratos en Agua de Bebida en los Partidos del Gran Buenos Aires"; Buenos Aires, 1988.

including: (a) increased production costs; (b) material damage and income loss; (c) the loss of recreational amenities, quality of urban life and ecological damages; (d) the threat to Argentine exports due to possible environmental restrictions in importing countries; and (e) the costs of global externalities. However, while an attempt will be made to illustrate some of these costs, the lack of adequate data does not permit a comprehensive evaluation at this time.

1.59 The inability to quantify the non-health costs of pollution should not be construed as an indication that these costs are insignificant or small. There are many examples of localized pollution that causes material damage in various forms. Pits and ponds at oil drilling sites cause damage that reduces the market value of the wool produced in Comodoro Rivadavia, where wool production is a US$100 million/year industry. Some pipelines in Mendoza, where wine is a US$200 million/year industry, have led to soil contamination and damage to vineyards. Also, pollution causes loss of income to tourism, as it suffers from any kind of visible pollution. In many cases, pollution has indirect costs through the aversive behavior of individuals. Many individuals avoid the air or noise pollution in downtown areas by moving to the suburbs, for which they incur large commuting costs. Other defensive measures, such as modifications to buildings (air filters, noise reducing windows, etc.) are also part of the cost of pollution.

1.60 In addition, pure air and clean water are among the environmental amenities that people value beyond their effect on health, income and production. The loss of these amenities makes people worse off and constitutes part of the economic costs of pollution. Particularly challenging is the valuation of ecological damage in cases where no directly measurable damage to humans occurs. The damage to birds that land in pits and ponds polluted with oil at drilling sites is an example. The damage to oceanic wildlife by the release of untreated sewage into the ocean (such as is reported to occur in Patagonia) is another example. Approaches for determining the non-use values destroyed through ecological damage exist. However, such an evaluation is not attempted in this study.

The Costs of Surface Water Pollution in Gran Buenos Aires

1.61 The pollution of surface waters in GBA, including the 80 km southern shore of the Río de la Plata (the *Franja Costera Sur*), and the heavily polluted streams that flow into it, most notably the Río Reconquista (at the northern end of the Franja), and the Río Matanza-Riachuelo (at the center of the Franja), has received a lot of attention and provides a setting for presenting examples of the approaches that can be used to estimate non-health related costs of pollution. The main sources of pollution are the urban sewage and industrial effluents that flow into the Río de la Plata directly, through the main sewer outlet in Berazategui, at the southern end of the Franja, or indirectly, through the Río Reconquista and the Río Matanza-Riachuelo. The low lying areas, which have become fairly urbanized, are are periodically flooded. The damage from the floods is aggravated by the heavy pollution load of the smaller streams, added to the overflow from septic tanks, which remain stagnant for weeks due to inadquate drainage.

1.62 The economic costs of this pollution are mainly non-health related, as most of the population relies on public water supplies or groundwater, and the health impact of surface water pollution are believed to be minor. The major non-health pollution costs include the increases in public water supply costs attributable to pollution, the losses from flood damages, which are aggravated by pollution, and the loss of recreational values. Unfortunately, with the existing data it is virtually impossible to make even rough monetary estimates of any of these costs. Nevertheless, the following considerations serve to illustrate the type of analysis that needs to be done.

1.63 *Public Water Supply.* The major source of potable water supply of Gran Buenos Aires, La

Table 6: The Cost of Flooding in the Matanza-Riachuelo Basin

Damage	Amount (US$ million)
public buildings	11.2
semi-durables	5.2
roads	3.5
homes	2.5
population evacuated	1.0
septic tanks	1.0
Total	24.4

Source: CEAMSE (1993)

Plata, Berisso and Ensenada are the treated waters from the Río de la Plata. All plants use conventional treatment systems, with the two most important being San Martin (2,500,000 m^3/d) and Belgrano (1,100,000 m^3/d). San Martin plant is located in Palermo, 30 km downstream of the Río Reconquista and of a number of smaller and very contaminated creeks and streams (Medrano, White, Vega and Maldonado). Until 1976, the San Martin water intake was located some 600-700 meters from the coast. Because of the high pollution levels, the intake point was shifted to 1,050 meters from the coast. Moving the water intake point was clearly a direct cost from pollution that must be considered a sunk cost today. The fact that the current intake remains downstream of the mouth of Río Reconquista might cause higher water treatment costs if pollution increases in future. However, water pollution parameters at the intake point at San Martin suggest that treatment costs are largely influenced by the high natural concentration of suspended solids, originating from the Paraná and Uruguay Rivers, than by pollution from sewage or industrial effluents.[41]

1.64 The intake point of the Belgrano plant at Bernal is located 2,500 meters from the coast, 12 km downstream of the Río Matanza-Riachuelo, and 12 km upstream of the discharge point for untreated sewage at Berazategui. Despite the favorable location of the water intake relatively to the sewage discharge, the entire estuary is subject to the effects of tides. Backflow occurs during high tide, but indications are that only a minimal part of the sewage eventually reaches the water intake at Belgrano.

1.65 *Flood Control, Including Health, Pollution and Aesthetic Improvements.* A contingency valuation estimate of the willingness to pay (WTP) to eliminate the risk of floods from the Río Reconquista was carried out by the government as part of a flood control project, financed by the IDB. As the analysis focussed on the total benefits of flood control, the share of value attributable to linked improvements, such as pollution abatement, health, and aesthetic values, cannot be separated. Based on a sample of 1,240 families, a survey indicated a WTP to avoid floods of of $ 81/month/household in areas subject to flood at least once every 10 years, and $ 75 in areas subject to flood at least once every 50 years.[42] Multiplying by the respective populations exposed to each type of floods leads to a total WTP of $ 135 million.

1.66 For the Río Matanza-Riachuelo basin there are no contingency valuation surveys, but the economic cost of floods and pollution has been estimated through a partial assessment of

41. Major parameters are: BOD: 0.9 mg/l; DO: 7.3 mg/l; COD: 3.3 mg/l; pH: 7.3; Total coliforms: 1850 NMP/100 ml; fecal coliforms: 95 NMP/ml; turbidity: 65 NTus; solids: 192 mg/l.

42. Such estimates appear to be high, since they are equivalent to double of the current level of municipal taxes.

Box 6: Benefits from Reducing Pollution in the Rio de la Plata

A Brazilian study measures the benefits of improving the water quality of the Rio Guaiba so that the population of the state capital Porto Alegre could enjoy bathing at the beaches of the river. According to the study, the WTP was US$ 6.6 per family per month, equivalent to 1.4 percent of the average income of the population of the city. In order to apply the results to Buenos Aires it would be necessary to know i) the population that would benefit from the recreational opportunity improvements and ii) estimate their WTP. The later can be assumed proportional to the two countries' per capita income (2.18 in 1992), or US$ 14.4 per family per month in Argentina. The number of families is more problematic: in the Porto Alegre study it was assumed that the population of the entire city would benefit (350,000 families) and that their monthly WTP would remain for the entire planning horizon (30 years). For illustration, we will make here more conservative estimates, namely that only a tenth of the population of greater Buenos Aires, thus 800,000 or roughly 200,000 families will benefit. Multiplication would give a value of US$ 35 million annually, or US$ 227 million over a ten year period for a discount rate of 10 percent.

the direct costs of damage (see Table 6).[43] As the study indicates, a number of costs have not been included, such as salaries and income lost, damage to capital of industries, damage to other infrastructure, and others, and their relative value cannot be estimated. Even incorporating all these new items, the estimates appear extremely conservative.

1.67 The economic cost of floods and pollution can also be estimated from the reduction in property values in the affected areas. As an illustration, the report on the Río Matanza-Riachuelo contains the information that in 80% of the area subject to floodings, the market value of properties is 35% lower than in adjacent non-flooded areas; and in the remaining 20% that is closest to the river, which is the risk area permanently affected by the pollution in the river, property values are 70% lower, meaning that in many cases they essentially have no market value. The total number of houses in the area is 89,000. Assuming (probably conservatively) that the average value of a house in the flood zone is US$ 10,000 and in the risk zone US$ 1,000 (these are precarious, irregular settlements), gives an overall estimate of US$ 266 million as the discounted present value of the flood and pollution risks. Unfortunately, here again it is not possible to separate the effects attributable to floods from those due to pollution.

1.68 *Recreational Losses from Pollution of the Río de La Plata.* In the Franja Costera Sur (between Tigre and Magdalena) there are some 21 *balnearios* (beaches). It is clear that the population would appreciate having cleaner water in the Río de la Plata and benefit from recreation and leisure, which have been reduced because of the high levels of pollution. One way to measure the costs of pollution is to measure people's WTP for improved water quality. In addition to having to ask individuals their WTP, it is also necessary to determine the population that would actually benefit from improvements (of course, different people would value the benefits differently according to factors like where they live, their income, their habits, etc). Since neither of these data are available, Box 6 presents some rough estimates to illustrate the eventual benefits form cleaning pollution in the Río de La Plata based on a study carried out in a river near Porto Alegre, Brazil, where both socioeconomic and environmental conditions are quite similar to those observed in the Franja Costera Sur.

43. CEAMSE, "Propuesta para el saneamiento de la cuenca del Río Matanza-Riachuelo", 1993.

Market Access

1.69 If lack of pollution control in Argentina limits access of Argentine exporters to international markets, this constitutes an additional cost of pollution. Pollution control may become an issue in negotiations for any future trade agreements that Argentina may wish to join. Within MERCOSUR, the current focus is on the harmonization of environmental policies. The specific conditions for Argentina to join a trade agreement are difficult to predict. Following from the experience of the NAFTA negotiations between Mexico and the USA, the focus would be on the alleviation of cross-border pollution issues (which are of relevance for Argentina primarily as a pollution receiving country, i.e. Río Paraná and Paraguay) and effective enforcement of national environmental regulation rather than a specified level of environmental standards.

1.70 Argentina is also likely to be affected by the increasing consumer preference, particularly in Europe, for products that are produced in an environmentally sustainable manner. The business community is aware of increasingly stringent environmental import restrictions, particularly in the European Union. Proliferation of ecolabelling mechanisms can be expected. When discrimination by importers is based on the environmental conduct of individual firms, Argentine producers would receive a price premium for environmentally sound production, and have, in principle, an incentive for implementing environmental controls even without government intervention. The government's role could lie in providing information to small producers and facilitating certification of environmental standards. On the other hand, if customer discrimination is based on environmental management in the country of origin, weak environmental management by the government itself has a cost, and firms individually have no incentive to improve environmental conduct.

Global Externalities

1.71 It is generally agreed that the buildup of greenhouse gases will increase average temperatures on the planet. The size of the effect is uncertain, but the current estimate of the International Panel on Climate Change (IPCC) is that average world temperatures may rise by 3°C by the end of the next century under their "business as usual" scenario. There is also great uncertainty about the consequences of global warming for Argentina. The major effects are expected to be on the productivity of agriculture, the survival of forests and other natural ecosystems, and human settlements in areas that are already vulnerable to flooding, droughts, landslides and windstorms. A change in weather patterns could shift vector borne and viral diseases to new areas, putting new populations, agriculture and other living systems at risk. However, climatic changes could also improve conditions in some areas.

1.72 Both the greenhouse effect and the depletion of the ozone layer (see para 0) are global phenomena. The damage Argentina may suffer from either of these effects is not directly related to Argentina's emission of greenhouse gases (GHG) and ozone depleting substances (ODS) but to global emissions. There is no direct link between emission reducing policies and a reduction in the possible damages to Argentina. However, Argentina is participating in the global efforts to achieve a reduction of emissions that cause international externalities, such as the Montreal Protocol and the Framework Convention on Climate Change. The costs of international externalities caused by Argentina are mentioned here to provide an appreciation of their value in relation to the costs of strictly domestic environmental concerns.

Table 7: Priority Ranking of Pollution Problems in Metropolitan Buenos Aires

Priority Problems	Number of People Affected	Effect on Poor	Health Effects	Non-Health Effects	Uncertainty about Effects	Irreversi-bility	Priority Rank
(a) Groundwater Pollution	High	High	Moderate to High	Low to Moderate	Low	High	1
(b) Air and Noise Pollution	High	Moderate	Moderate	Moderate	High	Low	2
(c) Uncontrolled Solid Waste Dumps	Low	Low	Low	Low	High	Moderate	3
(d) Surface Water Pollution	Low	Low	Low	Moderate	Low	Low	4

1.73 Estimations of the costs of damages caused by carbon dioxide emissions are laden with uncertainties. To give an order of magnitude, studies have been undertaken and estimate global damage costs for emissions in the current decade in the range of US$5-20 per ton of carbon emitted.[44] Based on Argentina's annual emissions of 116 million t of CO_2 from industrial sources, total damage costs from Argentina's CO_2 would be in the order of US$158-633 million per year.[45]

Priorities and Recommendations

1.74 This overview of pollution in Argentina would not be complete without an attempt to establish priorities among the environmental pollution problems that have been discussed. Because resources are scarce, the government needs to prioritize the range of issues that can be addressed realistically in each region and at the national level. Deciding on priority problems is ultimately a political process. Communities affected by environmental degradation, major polluters, environmental and public health experts, and government agencies should reach a consensus on the most critical problems. This consensus, however, must be supported by sound technical and economic analysis, a task which was only started in this chapter. It is important to note, however, that the proposed criterion for ranking priorities is economic cost, i.e., the value of losses due to the exposure and damages to humans and the environment that are attributable to pollution, and not the gross emissions of pollution.

1.75 While the estimates of the different categories of pollution costs are fraught with large degrees of uncertainty, and can only be regarded as illustrative, a preliminary determination of priorities can proceed on the basis of a set of substitute criteria that will approximately reflect the economic cost of the problems. The proposed substitute criteria include the number of people affected by health problems; the incidence on the poor; the effects on productivity and on the functioning of ecosystems; the uncertainty of effects and the risks involved; and the irreversibility of damages. In the absence of adequate data, the ranking is largely based on anecdotal evidence, and subject to revision and replacement whenever better information becomes available. Table 7 is a first cut at ranking pollution problems for the Buenos Aires metropolitan area according to the proposed criteria. The same approach can be used to obtain rankings for other parts of Argentina, if sufficient information were available.

1.76 *Groundwater pollution* coupled with lack of sanitary infrastructure should be considered the most severe pollution problem in the AMBA. The number of affected people is high as is the

44. World Bank, "Environment Dissemination Note No 4", 1994.

45. The mass of carbon dioxide is 3.664 times the mass of carbon it contains.

effect on the poor. Even though existing evidence seems to indicate that the health effects from water pollution and lack of sanitation are of much lesser significance than in other Latin American countries, they are still large. Moreover, people's willingness to pay for clean water supply far outweighs the direct health costs. Because of the number of people affected and the low infrastructure coverage in the outer municipalities, AMBA obviously stands out as the most critical area, but the same problem is likely to be important in other large and medium sized cities with high reliance on groundwater use and inadequate water supply and sewerage infrastructure.

1.77 *Air and Noise Pollution.* Even though the very spotty available data do not suggest that serious air pollution with far reaching damages is a area-wide problem in AMBA, localized problems in the downtown area, along the main traffic arteries, and near industrial sites, are likely to exist and affect a large number of people with significant health impacts. At least until systematic air quality measuring has established a clear appreciation of the extent of problems, air quality should be considered an important problem with a large number of people being affected. A similar problem occurs in other cities, such as Rosario and San Nicolás, with a high concentration of traffic and industry. In a few cities, such as Mendoza and Córdoba, where topography and the wind regime can lead to occasional weather inversions and the attendant accumulation of air pollutants to dangerous levels, it is possible that air pollution may deserve the highest priority among pollution problems.

1.78 *Uncontrolled Solid Waste Dumps.* Lack of treatment and/or adequate disposal facilities for hazardous waste, together with inadequate controls over current practices of industries disposing toxic, flammable and corrosive material means that a large proportion is being improperly and illegally disposed of in uncontrolled solid waste dumps, septic tanks and leaching pits, from where they leak into the groundwater and local streams. The very high uncertainty about levels of toxic pollution and their health effects make an evaluation very difficult. The fact that toxic pollution can be extremely persistent in the environment, so that the effects may be felt over long periods of time, emphasizes the importance of addresing toxic pollution problems. The problem appears to be most important in the AMBA, mainly due to the high concentration of industrial activities, but there are locally severe cases of hazardous waste pollution in other industrial centers, particularly in connection with the petroleum, petrochemical and mining industries in many parts of Argentina. Another problem in relation to municipal solid waste management, are inadequate collection services in some poor neighborhoods and irregular settlements.

1.79 *Surface water pollution* causes significant loss of aesthetic and recreational value in the rivers of the AMBA, but there are no indications of major impacts on health or productivity, as the existing water treatment plants do not appear to be significantly affected. As a result, the reduction of surface water pollution should only have a moderate priority in Buenos Aires, in comparison with other problems. However, in several inland locations, such as in Rosario, Córdoba and Mendoza where local water bodies have been polluted to the extent of affecting the workings of the water treatment plants. In these areas, obviously, the protection of public health and safety requires that surface water pollution be given a high priority.

1.80 *Global Concerns:* Greenhouse gas emissions and the attendant potential for climate change, represents a major concern at the global level. Ozone-depleting substances are also part of a global problem. While these concerns are real, they have been excluded from the ranking of national environmental priorities because, while Argentina is committed to address them, their relative priority can only be established in tandem with a global effort.

1.81 *Recommendations for Future Work:* The discussions in this chapter amply demonstrates the weak analytical basis for determining the costs of different pollution problems. Work in three separate areas of research and analysis would be extremely helpful for improving the information base on which future environmental priority setting would be based:

(a) *Ambient Environmental Monitoring.* In most parts of the country there is no basis upon which to make informed decisions about ambient environmental conditions. Critical gaps exist in the monitoring of water quality, both surface and underground, and there is virtually no systematic air quality monitoring in major cities, including Buenos Aires. Filling these gaps is a precondition for an assessment of pollution costs in these areas.

(b) *Health Environment Linkages.* While a significant amount of health data and studies are available, very little has been done to compile, correlate, and analyze the data in a manner that would allow analysis of trends and the health-environment interactions. More interdisciplinary surveys and studies are required to establish the population at risk from the various forms of ambient pollution and the actual degree of threat to public health and safety arising therefrom.

(c) *Economic Evaluation of Environmental Damages.* This chapter merely illustrated the use of economic evaluation methods to environmental problems. In-depth studies of the economic losses from surface water pollution, air pollution, and the deterioration of urban spaces would be invaluable to guide future policy choices.

2. Managing Municipal Water Pollution And Sewage

2.1 Household sewage is probably the most important source of environmental pollution in Argentina. Households also suffer from the consequences of pollution of their drinking water sources. Both problems are closely linked and involve similar questions with respect to the management of water and sewage companies. The problems of water pollution in the household sector are related to the lack of investments that would reduce pollution from households as well as pollution damages to households. Information failures, lack of access to credit and the need for coordinated investment suggest that an optimal solution to these problems requires some intervention or regulation. The role of households as producer and recipient of pollution is jointly analyzed in this chapter.[46]

2.2 Water and sewage services not only reduce pollution services but also provide other benefits such as the convenience of running water in the home and simple removal of effluents. To analyze the desirability and feasibility of expanding water and sewage services, all the joint benefits of these services need to be looked at. Therefore, this chapter discusses the total willingness to pay for services, which reflects not only pollution but also other benefits. Similary, an analysis of total willingness to pay is necessary to assess the options for financing system expansion and achieving the corresponding pollution benefits.

Current Situation and Institutional Framework

2.3 Argentina has by far the highest GNP per capita among middle-income countries in Latin America, but is among the lowest in water and sewerage coverage and suffers from serious water pollution problems. The shortfalls encompass the four major components of a water and sewerage system, which are closely interrelated: (1) water production and treatment; (2) water distribution; (3) sewage collection; and (4) sewage treatment and disposal.

2.4 The underinvestment and poor performance of the sector in the last 2-3 decades are particularly evident with respect to domestic and industrial sewage disposal. Argentina's urban population not connected to public sewerage systems has increased by more than one million in the last decade. The lack of adequate sewage collection, treatment and disposal facilities has created a highly vulnerable environmental situation, particularly at the fringes of large urban areas. Figure 3 shows the low service coverage particularly in the outer municipalities of the Area Metropolitana de Buenos Aires (AMBA).

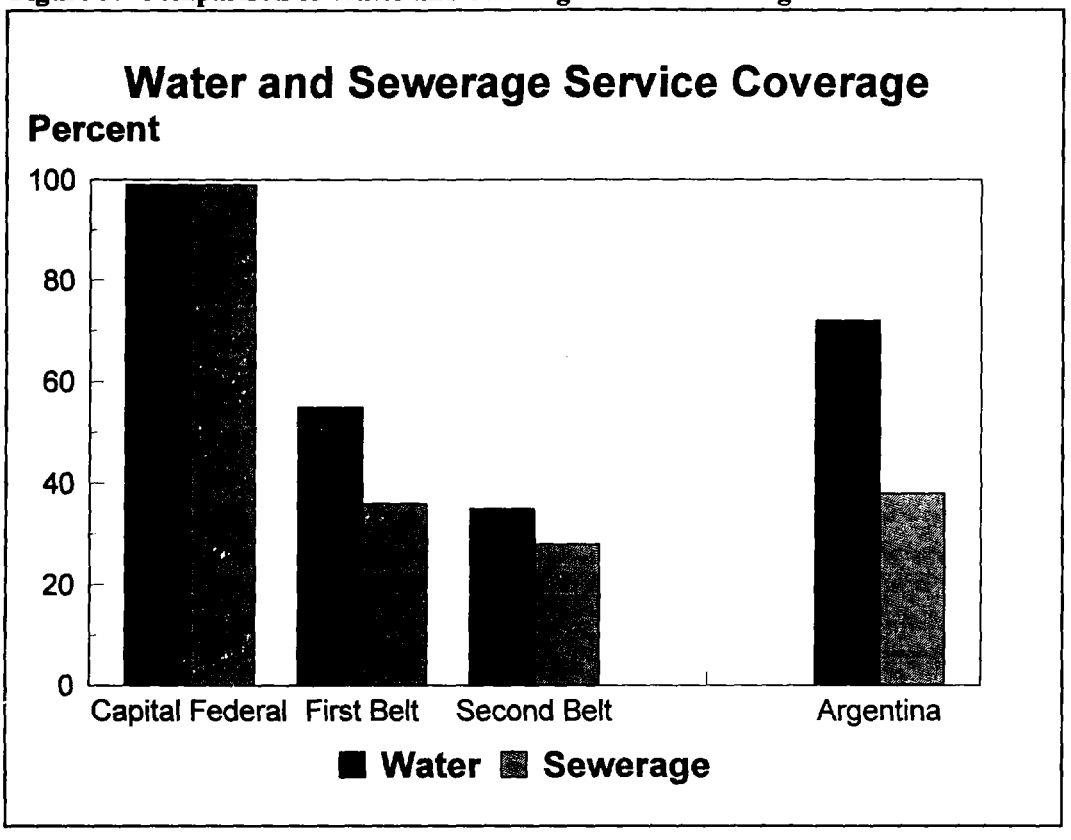
2.5 *Water Supply and Sewerage in AMBA:* AMBA, comprising the Capital Federal and 19 neighboring municipalities, with a population of almost 11 million representing 40% of the country's urban population, deserves special attention because of its magnitude, relative importance and the serious pollution problems it presents, which are typical for many other urban areas of Argentina. The water supply system in AMBA is as follows:

(a) about 6 million people in the GBA (Capital Federal and 13 municipalities) are served by a central supply system from the Río de la Plata, after conventional drinking-water treatment aimed mainly at removing its high natural content of suspended solids.

(b) about 4 million people in AMBA, who are not connected to public water supply systems, obtain their drinking water from individual wells, with virtually no quality monitoring. About half of these wells withdraw water from a shallow,

46. See also the recently completed World Bank sector report: Argentina: Water Supply and Sewerage Sector Note, July 27, 1994, Draft Report No. 12810-AR.

Figure 3: Comparison of Water and Sewerage Service Coverage



contaminated groundwater aquifer (Epipuelche).

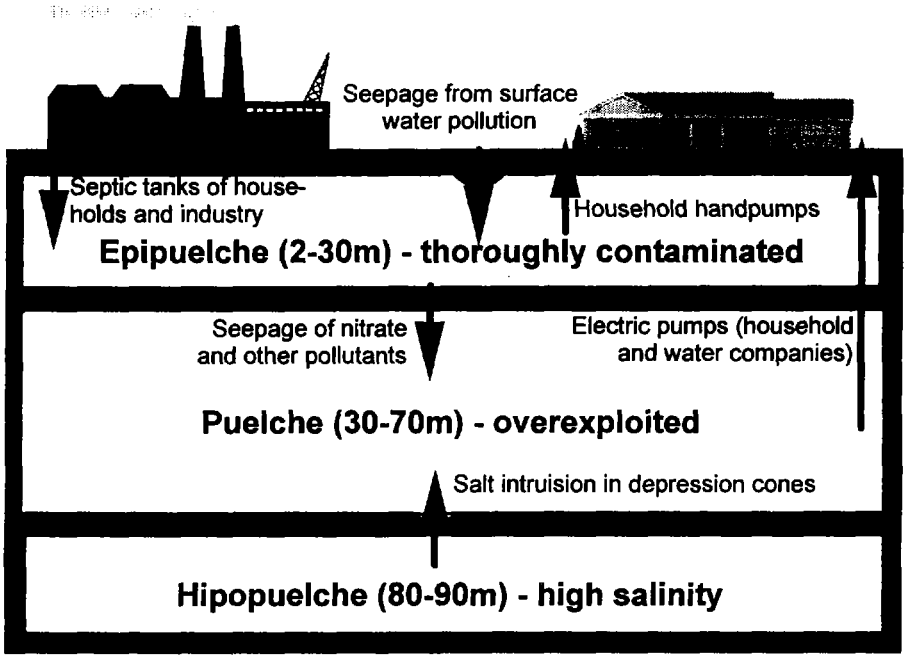
(c) in addition several hundred thousand people receive their water from public systems fed by wells pumping from a deeper, more protected aquifer (Puelche). However, uncontrolled use of this aquifer over the years has caused in many areas serious salinization problems, as well as high nitrates exceeding the allowable limits in drinking water.

2.6 In regard to sewerage disposal in AMBA:

(a) about 5 million people rely on septic tanks, cesspools, or other on-site systems for excreta disposal, directly into the shallow Epipuelche aquifer. The domestic on-site systems are the main cause of contamination of this aquifer as well as of the high nitrate concentrations in the Puelche aquifer (see Figure 4). The liquid sludge from the septic tanks, which is periodically removed by maintenance trucks, creates an additional environmental hazard in the area, because of the bad odors at most dumping sites, the overload created in the sewage collection system and treatment plant, and the contamination of surface water sources.

(b) another 5 million people are connected to the central sewage collection system, which discharges large amounts of untreated sewage to the Río de la Plata. Smaller amounts of domestic sewage (partly treated), as well as untreated industrial wastes, are discharged into the main Río de la Plata tributaries—the Río Reconquista and Río Riachuelo—as well

Figure 4: Groundwater Pollution Problems



as several creeks and canals crossing the metropolitan area. Only a very small percentage of sewage receives treatment of any type, and many of the existing treatment plants are overloaded, poorly operated and maintained, and represent an environmental nuisance.

2.7 Lead in air has been shown to have a strong correlation with blood lead levels, which are associated with neurological damage in children and with high blood pressure in adults. Lead at even low doses is associated with lower IQ scores, impaired attention, speech and language deficits and behavior disorders. These deficits are significant since they may have long-term effects on childrens' educational attainment and employability. In addition, several studies indicate that at high concentrations lead may be carcinogenic. Because children inhale a proportionally higher daily volume of air per weight measure than adults, they are more susceptible to lead in ambient air.[47] Even though systematic data from Buenos Aires are not available, indicative damages from lead pollution are calculated in Table 8.

2.8 *Institutional Framework:* The water and sanitation sector has undergone several major reforms in the last three decades. The most important of these are: (1) the 1980 decentralization reform, when the Provincial Governments took over from the National Government the responsibility for their own water and sewerage services, and the national company (OSN) remained in charge of GBA only; and (2) the 1992 privatization reform, prompted by the underinvestment and

47. Margulis, Sergio, "Back-of-the-Envelope Estimates of Environmental Damage Costs in Mexico", WB Policy Research Paper, No. 824, 1992. Barrie, D., "Environmental Protection in Federal States: Interjurisdictional Cooperation in Canada and Australia", Australian National University, Federalism Research Center, Working Paper No. 18, 1992.

Table 8: Aguas Argentina's Investment Plan (1994-2023)

	Water Expansion*	Sewage Expansion*	Old System Rehabilitation	Wastewater Treatment	Total
Investment Present Value @10% ($ million)	542.4	497.9	194.3	370.9	1605.6
Total Investment ($ million)	1227.6	1385.5	558.3	936.5	4107.8
Investment per Capita ($)**	289	291	93	96	769

* Including investment cost recovered from customers through the infrastructure charge.

** Assuming that customers are added proportional to total investment funds budgeted over time.

inefficiency of the water companies, which brought about the privatization of the water and sanitation services in GBA and other provinces, using management contracts.

2.9 A 30-year concession for the water supply and sewerage services of GBA was awarded in 1993 to Aguas Argentinas (AA), after a thorough and successful process of preparation and bidding, which lasted almost two years. The concession contract sets up yearly performance targets that must be complied with, such as: water and sewerage coverage, percentage of wastewater to receive treatment, percentage of unaccounted-for water, etc. It also includes quality requirements which are gradually tightened, for potable water, sewage discharged to collectors, and effluents discharged to water courses. The investments needed for complying with the above contract for the 30 year concession period are summarized as totals and present values in Table 9.

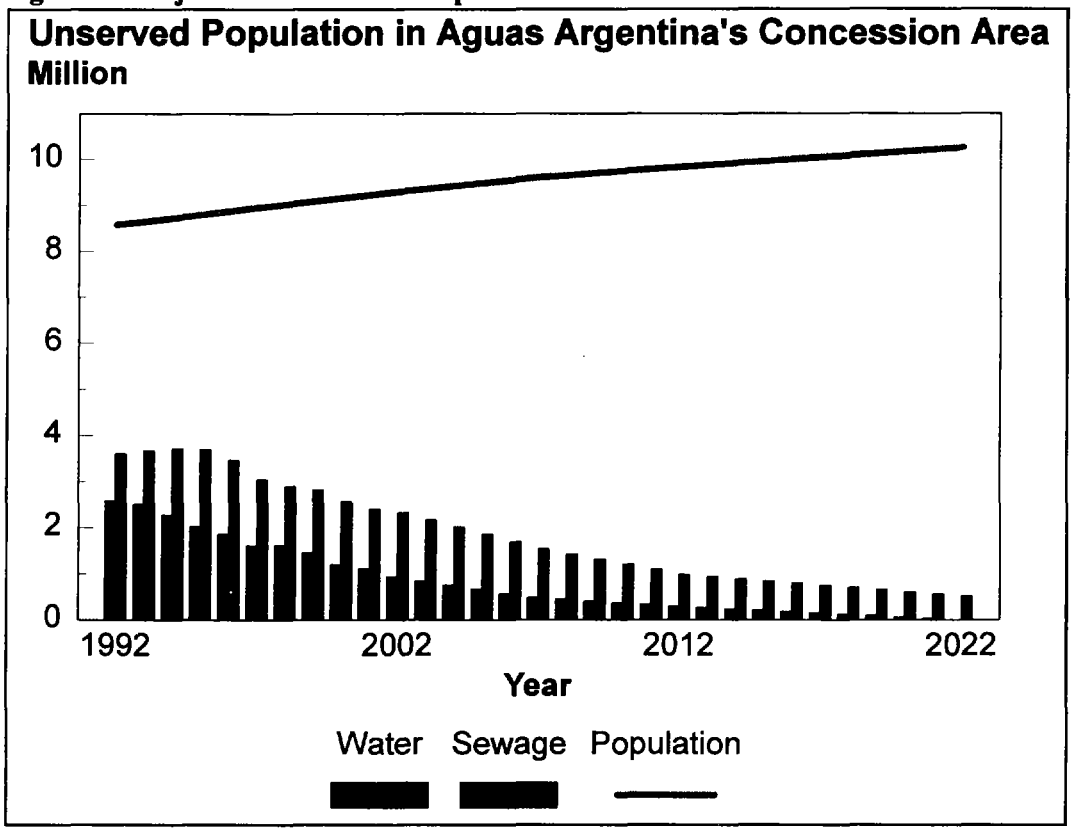
2.10 A new regulatory agency—ETOSS—as set up for GBA to supervise compliance with existing norms and the provisions of the concession contract. A large number of cooperatives and communal organizations provide water supply and sewerage services to some 250,000 people in AMBA. The level of services provided and the performance of these entities vary greatly. Some of these entities which operate in the GBA concession area are regulated by ETOSS, while others are not regulated at all.

2.11 While the operational functions related to the provision of water and sewerage services were fully and clearly transferred from OSN to AA, OSN's regulatory functions related to environmental protection was not fully transferred to ETOSS. SERNAH, through its Water Pollution Control Department ("Dirección Nacional de Control de Control de Contaminación Hídrica"), is responsible for the control of domestic and industrial sewage contamination in the entire country. The present role of SERNAH vis-à-vis AA is not clear. Theoretically, SERNAH should set up the norms and enforce and control them. In practice, this role is partially fulfilled by ETOSS, which oversees AA's compliance with the concession contract. The unclear regulatory situation with respect to industrial wastes discharged into the sewerage network, and the difficulty to enforce regulation in a large number of industries, is creating serious problem in the GBA concession area. Similarly, institutional responsibility for water pollution control in AMBA (outside the AA concession) is split among various entities.

Policy Issues

2.12 The key policy questions of the sector is how the regulatory framework should be designed such that it encourages development of least-cost operation and expansion of the

Figure 5: Projection of Unserved Population in GBA



infrastructure and addresses the need to meet the basic needs of the urban poor. This section address the following policy issues: (i) what are the benefits and costs of service expansion and how can services be expanded to consumers with sufficiently high willingness to pay; (ii) how can service cost reductions increase the share of consumers that can afford water and sewerage services; and (iii) what are the options for supplying consumers without sufficient willingness to pay. The last sections address policy issues of (iv) water quality; and (v) sewage treatment.

Service Expansion

2.13 In GBA, the concession contract determines the expansion of water and sewerage services according to a schedule that determines coverage for the 30 year concession period. By the end of the concession, coverage will reach 100 percent for water and 95 percent for sewerage based on a population forecast of 10.3 million. Despite the ambitious AA expansion plans, a large number of people will remain unserved in GBA for many years to come (see Figure 5). The expansion plans are not strictly defined by geographic areas. An immediate result of this "flexibility" is pressures exerted on the private concessionaire, through the public regulatory agency, resulting in continuous changes which may cause implementation delays. According to present expansion plans, there will be an increasing number of people with access to public water supply but without access to public sewerage. This will create larger amounts of sewage to be disposed by on-site systems, and therefore higher contamination potential of groundwater sources.

2.14 *Service Costs.* Due to fragmentation of the sector, there is very little comprehensive data available on the cost of water and sewerage services. Nevertheless, indicative cost figures for

Table 9: The Cost of Water and Sewage Services

	Annual Costs/Capita ($)			
	Investment Cost	Connection Cost*	Operating Cost	Total Costs
Urban House Connection, Water (400 l/day)	20-30	5	16-26	41-61
Urban House Connection, Water (400 l/day) + Sewage	46-70	11	16-26	73-107
Urban House Connection, Simple System (200 l/day)	10-26	4	8-13	22-43
Urban Communal Connection, Water (100 l/day)	9	0	4-6	13-15
Rural House Connection, Water (300 l/day)	23-27	5	36-60	64-92
Rural House Connection, Water (300 l/day) + Sewage	63-77	11	36-60	110-148

* Assuming five people per connection.

some order-of-magnitude comparisons of costs and benefits are presented. The costs of water and sewage services comprise investment costs per connection and operating costs per unit of water. Water production costs (operating costs) have been estimated at $0.11-0.17 for urban areas (Santa Fe, Mendoza, San Juan, and GBA), and $0.33-0.56 for rural areas (Corrientes, Córdoba, Jujuy, Formosa, Neuquen).[48] AA operating costs in the GBA concession, estimated from the overall annual expenditures (reported to be US$240 million) and estimated yearly volumes of water produced (approx. 1,300 million m^3), are some US$0.18 per m^3 of water produced. The breakdown into main components is estimated to be as follows:

Water production, treatment and pumping
$0.06 (35%);

Water distribution and sewage collection
$0.09 (50%);

Commercialization and system management
$0.03 (15%).[49]

2.15 The investment costs for expanding water supply in Argentina are estimated at US$200-250 per capita. Investment costs for sewage and sewage disposal are estimated at US$250-350 per capita excluding connection costs.[50] The total annual per capita costs of water and sewerage services based on a 10 percent real discount rate are summarized in Table 9.

The Benefits of Sanitation Services

2.16 Based on the approaches presented in Chapter 1, this section attempts to quantify the costs of lack of sanitation service, which constitute the benefits of service expansion. Clean water reduces health risks and provides other benefits such as the convenience of continuous supply and indoor water supply. The benefits of supply of clean water accrue directly to the household that receives, and possibly pays,

48. Asociación Argentina de Ingeniería Sanitaria y Ciencias del Ambiente, "Resumenes Sectoriales de Abastecimiento de Agua Potable y del Saneamiento", Report for the Pan American Health Organization, 1993.

49. Aguas Argentinas, "Memoria y Estado Contables al 31 de Diciembre de 1993", Buenos Aires, 1994.

50. World Bank, Argentina: Water Supply and Sewerage Sector Note, Draft Report No. 12810-AR, July 27, 1994.

Table 10: Willingness-to-Pay for Sewage Collection

$ per Month per Household/ Location	Average WTP	Low Income WTP	High Income WTP
Ascension (Buenos Aires)	34.62	27.54	40.70
Puerto Deseado (Santa Cruz)	55.38	49.44	57.05
Fuentes (Santa Fe)	43.44	33.86	53.76
Villa Gral Belgrano (Cordoba)	45.19	34.66	50.02

Source: COFAPYS

for this service. The absence of sewage collection and sewage treatment causes pollution of groundwater and surface water resources. Pollution leads to higher water treatment costs downstream and loss of amenity value through foul smells and closure of beaches. The collection of sewage has benefits that accrue directly to the household (convenience of sewage removal, improved hygiene in the house). However, additional benefits accrue to the neighborhood (reduced risk of groundwater pollution and the attendant effects on health). Finally, the benefits of sewage treatment are almost all external. These benefits are the aesthetic value of unpolluted surface water as well as the health benefits of reduced risk of contamination from surface water use.

2.17 The benefits from water and sewerage services are closely related. The operation of sewage collection systems generally requires availability of sufficient quantities of water. Piped water supply, on the other hand, leads to a drastic increase in water consumption and demand for some form of wastewater removal. Without sewage collection, the increased quantity of wastewater would lead to increased spread of contaminants. Because of the close complementarities between both services, they are analyzed jointly.

2.18 *Health Benefits.* Reduced risk of intestinal disease is one of the benefits of access to safe water and sanitation services. Using a reduction of 0.05 cases of diarrhea per person served with running water (from the Jujuy data, see para. 1.46), these costs would lead to annual health benefits for diarrhea morbidity of $4.50. Assuming an annual capital and maintenance cost of water connection of $30 per person and a mortality risk reduction of 0.00004 per person, the additional mortality benefits would justify the cost of connection if a case of premature mortality is valued at $637,500 or more. Using the more conservative international estimates (mortality reduction of 0.000013), a cost of one case of premature mortality valued at $2.18 million would justify the cost of water supply.

2.19 *Willingness to Pay.* Another approach to the estimation of benefits is through the individuals' willingness to pay for water, i.e., for the the amenity of sewage removal and running water in the house. The two commonly used approaches for determining willingness to pay are surveys and observation of actual market transactions. Actual payments for water in areas where public services are provided can be used as an estimate of minimum willingness to pay. These estimates of willingness to pay allow high confidence since they are based on actual payments and not only declared intentions. The typical tariffs in water cooperatives range from

$3-27 per month per household.[51] $5 per month per household is a very common tariff for simple systems without sewage collection. With a few exceptions, collection rates range between 90-100% suggesting that these rates do not exceed families' willingness to pay for these services.

2.20 The purchase of bottled water by households without access to other sources of safe drinking water can also be used as an approximation of willingness to pay for water. Bottled water consumption of one liter per person per day is an often quoted figure. At a price of $0.6/liter, this amounts to a monthly willingness to pay of $18 per person, or $72 per household. In places with very low quality of alternative water sources (for example in San Fernando where groundwater is highly saline) bottled water purchases can be observed even among low income groups. Note, that for a family at the poverty line, expenditures of $18 per person would constitute 18% of the household budget.

2.21 Surveys indicate that, in Argentina, willingness to pay is often sufficient for financial viability of sewage collection. Preliminary analysis of willingness to pay for sewage collection is available from an ongoing contingent valuation study for COFAPYS. Average willingness to pay for sewage collection averages from $35-55 per month per household. Interestingly, even for the lower income groups, willingness to pay is high with $27-50. This represents 7-12% of the income of a 4-person family at the poverty line (see Table 10). These high values can be explained by considering the reduced inconvenience and cost of operating on site disposal systems. For example, septic tanks need to be emptied at regular intervals at a cost of $30-120 per year.

2.22 In 1993, the share of the urban population with per capita household income below the indigent line of $50 per month was estimated as 3.4%. The indigent line represents extreme poverty and is established by determining the prices of a basket of the required food items. The share of the urban population below the poverty line (estimated at $102 per capita per month) was estimated at 17.6%.[52] The annual costs full of water and sewerage services (about $73 per capita, including capital and connection costs) would equal 6% of income at the poverty line.

2.23 Five percent of income has often been estimated in other countries as a typical willingness to pay for water and sewage services.[53] Thus, it could be concluded that essentially everyone above the poverty line, or at least 82% of the urban population, would be willing to pay for the full cost of services. Taking the example of GBA, where a population of more than 4 million lacks water house connections, and 1.9 million people live below the poverty line, the share of the currently unserved population willing to pay the full cost of services would be in the range from 52% (if only the poor were currently unserved) to 82% (if current service coverage was equal for all income groups). Based on the 1984 census, 1.15 million people were considered structurally poor (*necesidades básicas insatisfechas*). If this group was completely unserved at current, it would represent 29% of the total unserved population.

Addressing Obstacles to Service Expansion

2.24 The evidence presented above clearly indicates that the willingness-to-pay of a large share of the currently unserved population is sufficient to cover the full costs of water and

51. Brunstein Fernando, "Gestión de los Servicios de Agua Potable por Organizaciones Cumunitarias en el Gran Buenos Aires, Evaluación de Resultados", Centro de Estudios Urbanos y Regionales, Buenos Aires, 1992.

52. World Bank, "Argentina's Poor: A Profile", Draft Report No. 13318-AR, July 14, 1994.

53. Several studies in Brazil show a willingness to pay of between 2.8-6% of income for sewage services alone. See Carrizosa, Santiago, August 1993, Transferencia de Beneficios Ambientales en Latinoamérica, Banco Interamericano de Desarrollo. A contingent valuation study in Nigeria confirms that poor households are willing to spend 18 percent of family income on water. These estimates are consistent with observed expenses of 18 percent on purchases of trucked water; see Dixon John, Loiuse F. Scura, and Paul Sherman, 1994, Economic Analysis of Environmental Impacts, Earthscan, pp.181-186.

Box 7: Stylized Cost and Tariff Example

Stylized Comparison of Capital Costs and Tariff

Capital Costs

The investment costs over the lifetime of the concession (after deducting the infrastructure charge to customers), converted into a constant annual capital charge per customer (assuming a real discount rate of 10% and five people per connection):

New Water and Sewage Connection	$47.60/capita
Rehabilitation of Existing Connection	$9.40/capita

Both figures include the cost of future sewage treatment. Note that the capital costs for existing connections are significantly lower since the concession does not pay for the existing infrastructure.

Existing Uniform Tariff

Except for the infrastructure charge that covers part of the cost of new customers, the existing uniform tariff structure does not distinguish between old and new connections. A uniform constant per-capita tariff for all customers that would fully cover the total cost of capital according to the concession's investment plan would have to be:

Uniform Cost of Capital for All Customers	$17.00/capita

Even though this calculation is based on a model, the result approximates the actual contribution made by current revenues of the concession to investment costs.

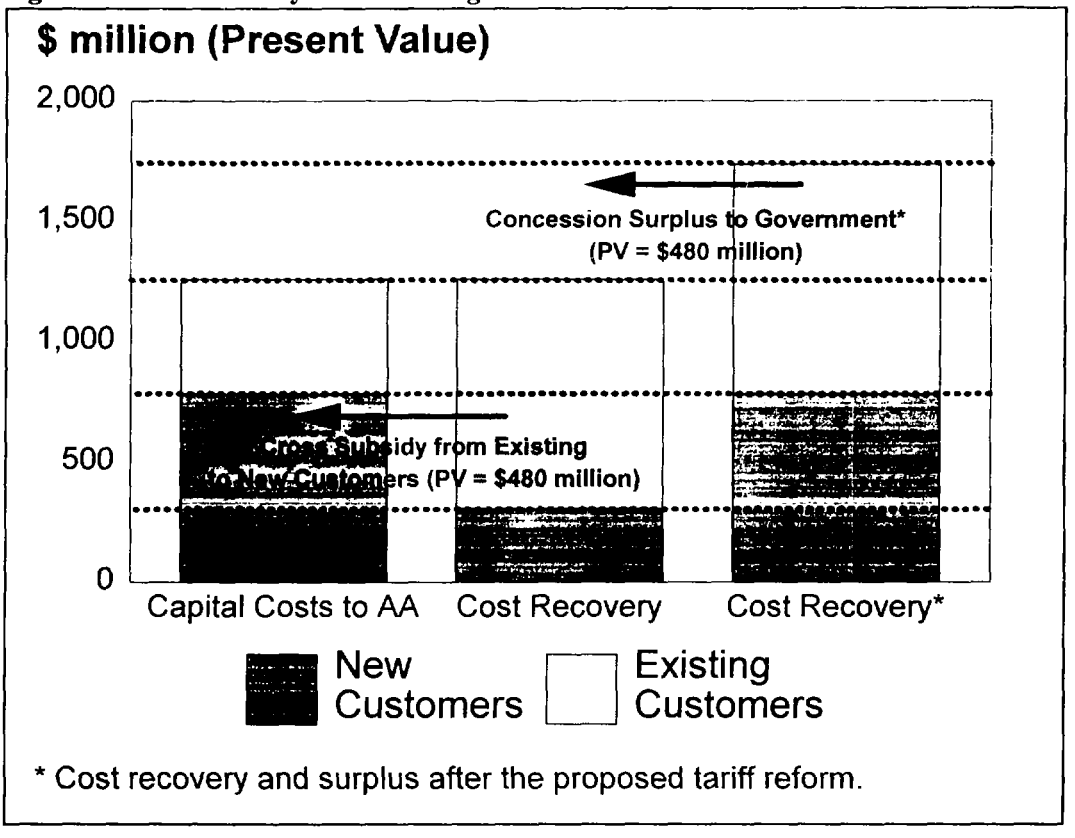
Given a total of ---- customers, the foregoing implies that the present value of capital charges to new consumers over the lifetime of the concession is only $306 million compared to costs of $785 million. The difference of $480 million is paid through revenues from existing customers.

sewage collection services (investment and operating costs). This willingness to pay is a reflection of not only the health benefits but also the amenities and convenience associated with water and sewage services. The total willingness to pay is important because it demonstrates the possibility of self-financed solutions to the pollution problems in the water sector. Hence, if the prevailing hesitance to recover capital costs from the customers can be overcome, the expansion of services can be made financially viable in many areas. The main constraints limiting the expansion of serviced to consumers with sufficiently high willingness to pay are: (i) in GBA, the absence of incentives for service providers to expand services; and (ii) in other parts of the country, the lack of access to credit by consumers and service providers to cover the investment costs of service expansion.

2.25 *Incentive Problems.* In GBA, the constraint on the expansion of sanitation services to the unserved part of the population with sufficiently high willingness to pay is mainly an incentive problem. Currently, water and sewage tariffs are uniform across old and new customers. Current water charges are higher than operations costs but do not cover the full investment costs. The concession is financially viable because AA does not pay for the existing infrastructure. In effect, the share of water revenues from existing customers that exceeds operation costs is used to cover the share of system expansion costs that is not recovered from new customers. A stylized presentation of the current tariff structure is discussed in Box 7.

2.25 The most significant issue with the existing tariff structure is that AA's revenue from incremental customers is less than the cost of

Figure 6: Cross Subsidy from Existing to New Customers of Water/Sanitation Services



services provided to them. Therefore, AA has no incentive to accelerate the expansion of service coverage beyond the expansion targets agreed upon in the concession contract even if those potential new customers were willing to pay the full costs of services provided to them. As 6 shows, the size of the cross subsidy from existing to new consumers is of the order of $480 million in present value terms.

2.26 The incentive problem can be overcome through case-by-case renegotiation of the concession contract. For example, in 1994, a 13 percent tariff increase was granted to AA in return for (i) the advancement of service expansion; (ii) the provision of drinking water to some low income neighborhoods; and (iii) the replacement of water from some nitrate polluted wells. However, a more systematic solution to the incentive problem, through a mutually agreed change in the tariff structure of the concession contract, may be desirable. This change would allow AA to recover the long-run marginal cost from new customers. This would imply an additional annual capital charge of $14.6 for water and $14.3 for sewage per person. In return, AA would have to pay, over the lifetime of the concession, an infrastructure charge for the use of the existing infrastructure of about $480 million in present value terms (see Figure 6). This would leave AA's net financial position unchanged but would create the incentive for establishing service as early as possible to all customers willing to pay the full costs.

2.27 The second issue is the finite duration of the concession in the absence of an agreement for repurchase of new investments by the regulator. At the end of the concession period, investments made by AA will be transferred to the next concessionaire without compensation for AA. In effect, a part of current tariffs is used to finance future service expansion to customers from which investments cannot be recovered during the short

remaining time within the concession. This arrangements creates strong incentives for AA to minimize investing toward the end of the concession period. For example, incentives to use low quality building materials or reduce the expansion targets (revenues from customers connected toward the end of the concession will be close to zero) would require very strict, and possibly costly supervision of the concessionaire. This problem could also be addressed in a revision of the concession agreement.

2.28 *Financial Constraints.* The second constraint on service expansion is access to credit. Many water utilities outside of GBA are not considered sufficiently creditworthy to obtain the capital required to extend services to the unserved population. (Required investments to cover all currently unserved urban and rural concentrated population in all of Argentina would be in the order of $1.9 billion for water and $5.5 billion for sewage.[54]) In addition, low-income consumers are unable to pay the investment costs of water connection upfront and do not have sufficient access to credit. Following the example of GBA, commercialization of services with the effect of increased operating efficiency and allowing tariff levels that lead to financial viability would appear to be the most promising route for improving access to capital by water and sanitation companies. The complex issues involved in the commercialization of provincial services will be assessed in more detail in an upcoming Bank sector study of provincial infrastructure services.

2.29 At this time, as the result of remaining constraints in the banking sector, liquidity constraints of new customers create additional limitations on the expansion of service coverage. The total connection and infrastructure charges for a new water and sewage connection of about $1,660/household (the infrastructure charge is payable in 12 bimonthly installments) can generate problems of affordability even for those households that would be perfectly able to afford the full costs if they were financed at the cost of capital of the service provider. For this reason, the service provider should be encouraged to widen financing options for these charges. Again, tariffs that recover the full costs would be required to generate the incentives to the service provider to offer such flexible arrangements that could be in both sides' interest.

Service Cost Reductions

2.30 Considerable welfare gains could be obtained by reducing the costs of water and sewerage services. In addition, the share of the population that can afford and would be willing to pay the full cost of water and sewage services can be increased by reducing the costs of services. The first approach is to improve operational efficiency of the water utilities. An important step toward this objective is the competitive bidding for concession contracts that has occurred in GBA and Corrientes. There are questions about how the design of concession contracts can be improved to increase incentives for higher operating efficiency. However, significant costs savings are expected as a result of efficiency increases from the commercialization of services alone.

2.31 In the GBA concession, consumption is not metered for most residential customers. Out of 1.5 million residential connections, only 240,000 were metered in 1991. This number has now been increased to 350,000. As a result of the virtual absence of residential consumption metering, and the high percentage of unaccounted-for water (over 50%) due to physical losses (leakage) as well as commercial losses (illegal consumers), average *per capita* water demand in GBA, and particularly in the Capital Federal, is very high. Consumers without meters have no incentives to reduce water consumption; thus, their consumption and costs per connection are inefficiently high.

2.32 The current lack of metering creates an important opportunity for cost savings. Demand

54. Calculated by multiplying the number of unserved, 8.3 million and 18.3 million, with the per capita cost of $225 and $300 for water and sewage, respectively.

management will be carried out through installation of water meters and a series of measures aimed at gradually reducing the unaccounted-for water. In 1995, Aguas Argentinas will start metering consumption of all non-residential customers. All new residential customers will also be metered. During a transition period, service to existing customers can be converted to metered service at the request of either AA or the customer. As a result of these measures, AA expects to reduce water production from the current level of somewhat less than 600l per capita per day to about 400l. These savings can result in lower average tariffs for consumers.

2.33 Water conservation measures, such as the use of water-saving plumbing fixtures, combined with wastewater recycling and reuse for industrial purposes as well as for landscape irrigation, may bring important savings and environmental benefits. Reuse of sludge from septic tanks or from treatment plants may be possible as agricultural fertilizer.

Services in Low Income Neighborhoods

2.34 The problem of service provision in low-income neighborhoods is intricately linked to the problem of urban poverty and cannot be solved through measures in the water and sanitation sector alone. Ultimately, higher incomes will be the key to overcoming these problems. However, some targeted intervention in the water and sewage sector can be defended as complementary measures for poverty alleviation and the promotion of public health.

2.35 Within the agreed expansion schedule, AA has some limited scope for selecting the order in which areas within each municipality will receive services. Since services in low income neighborhoods are less profitable than in high income neighborhoods (with unmetered services, tariffs are higher for larger houses; with metered services, higher consumption in high income areas increases revenues; also collection costs and losses are lower in high income areas), it can be expected that low income areas will receive services last within the scope left by the concession agreements. Even though the concession contract stipulates coverage with water service of 100 percent by the end of the concession, it is unclear whether the concession contract mandates AA to provide services to low income neighborhoods, especially to irregular settlements and "villas miserias", where tariff collection would be questionable.

2.36 Problems of services in irregular settlements are aggravated by the fact that many of these settlements lie in flood prone areas and property rights are often not established. Regular flooding limits the technical options for service delivery. Without established property rights, tenants would be unlikely to pay the connection and infrastructure charges even if they were able to pay. The latter problem could be alleviated if the service provider finances the connection and infrastructure fee, and charges the current tenant on a rental basis.

2.37 *Low Cost Systems.* About one third of the population not served with public water and sewerage services in AMBA is defined as "poor" in accordance with socio-economic criteria. This segment of the population, which cannot afford to pay for conventional services even if they were offered to them, is the highest-risk population from a public health point of view. Non-conventional, low-cost technologies providing lower-quality service at an affordable cost, can spell hope for this population, most of which lives in the "second belt" communities around the Capital Federal. The factors that can reduce costs of water supply are changes in the location of water connections, reduction in water pressure, and water quantity.

2.38 Small scale neighborhood development projects with a high degree of participation by the beneficiaries have shown that water and sewerage services can be supplied at a significantly lower cost than the conventional approach costing about $200-250/*cap*. For water and $250-350/*cap*. for sewerage. The investment cost for urban water

supply are estimated at $90/*capita* for public taps.[55] Typical investment costs of water cooperatives are in the order of $300-450 per connection or $75-113/*capita*.[56] These figures include house connections but are based on very simple local systems for the distribution of untreated local wellwater and lower service quality (often low pressure, service interruptions, and lower quality materials). In the San Jorge Barrio of the Municipality San Fernando, IIED is involved in a project that provides low cost water and sewage services. The costs for dual water connection and a collection system for liquid effluent are $1,100 per connection ($220/*capita*). This dual system includes a drinking water pipe with limited supply and a saline water pipe for all other uses.

2.39 Also for sewage disposal/collection, there are low cost intermediate solutions that provide similar benefits to commercial sewage collection systems at a lower cost:

(a) *Simplified Sewerage.* This type of sewerage system is designed in accordance with less stringent criteria (minimum diameter, minimum slope, minimum depth, spacing of manholes, and design period). Simplified sewerage has been successfully used particularly in Brazil, but also in Colombia, Paraguay and Bolivia. Experience in Brazil indicates that investments in simplified sewage collection systems were US$90 to US$160 *per capita*, almost half that of conventional sewage collection systems for similar areas.[57]

(b) *Solids-free sewerage ("small-bore system").* This system is a combination between the use of on-site disposal in septic tanks and a conventional sewerage system with smaller diameter. Sewage flows by gravity from the house to a solids interceptor tank. From there the settled effluent ("free" of solids) is pumped to the sewerage network. This system was developed in the U.S. and Brazil in the 70s and it has since been used in various countries. It has also been used in Argentina, in the San Jorge community (see above) as well as in the city of Junin in the province of Mendoza.[58]

(c) *Condominial sewerage.* While in conventional sewerage each house is connected to the street sewer by individual, independent house connections, in the condominial system groups of houses are connected together to the street sewer by shallow, small diameter sewers, laid at flat gradients, which run through backyards and pass through private properties. House connections are much shorter and the design parameters are similar to those of simplified sewerage. Experience has shown that the key to successful application of this system is a strong community organization and participation. Cost savings are similar to those obtained in simplified sewerage.

2.40 The AA concession does not provide for special arrangements with low cost systems. However, it gives AA a veto right over water and sewage projects in yet unserved areas within the concession. It needs to be assessed whether contract modifications would be necessary to generate incentives for AA to provide low cost services where these are the economically best solution. These efforts should build on the positive role that cooperative organizations can

55. AIDIS estimate, 1992-$.

56. Brunstein Fernando, "Gestión de los Servicios de Agua Potable por Organizaciones Comunitarias en el Gran Buenos Aires. Evaluación de Resultados", Centro de Estudios Urbanos y Regionales, Buenos Aires, 1992.

57. Alexander Bakalian, Albert Wright, Richard Otis and José de Azevedo: "Simplified Sewerage Meets Demands", Water Environment and Technology, March 1993.

58. Obras Sanitarias Mendoza: "Sistema Cloacal Junín", Descripción General del Sistema, Octubre de 1994.

play in mobilizing participation of the beneficiaries.

2.41 *Social Tariffs.* There will remain a group of potential consumers who cannot even afford the full costs of simpler low-cost systems, and there is often the temptation to keep general tariff levels low to protect these consumers or to differentiate tariff levels by consumer income. However, tariff caps and socially differentiated tariffs distort the incentives to consumers and producers of services. In particular, if tariffs charged to the poor did not cover the full costs of services, water companies would have no incentive to expand services into poor neighborhoods.

2.42 Explicit lump-sum subsidies to support low-income consumers are preferable to tariff cross subsidization. Water companies could charge for every poor consumer a fixed block rate to the government but charge the full cost of any additional consumption directly to the consumer. In the case of GBA, this subsidy could be paid out of the returns to the existing sanitation infrastructure. These implicit returns are currently distributed across all consumers. As discussed before, there may be about 1.5 million unserved individuals in GBA who cannot pay for the full cost of services. If full water and sewage services were extended to all of these individuals (installed over the 30 year concession period in proportion to the overall expansion rate), the present value of full water and sewage service costs (investment and operating costs) to all these 1.5 million consumers would be about $518 million. Hence, the incremental revenue from the recommended change in the tariff structure (charging all new consumers the full cost of capital of their services, resulting in additional revenues with a present value of $480 million) could be used to fund almost the full costs of water services to all currently unserved individuals below the poverty line.

Water Quality

2.43 Water provided by cooperatives and other entities operating in GBA is generally less safe than that supplied by AA. Stricter regulation than presently exists is required for these entities. The deterioration of groundwater quality will presumably create growing demand for water supplied by AA. However, it appears that a growing number of "third-party" operations will take place in the near future to solve immediate problems in areas not reached by the concession.

In the long range, with the continuous deterioration of groundwater quality, these operations will presumably disappear, as soon as the concession is able to provide services to most of the area.

2.44 A large number of wells contain high concentrations of nitrates, above the present standard of 45 mg/l. The chief reason for the nitrate problem is the contamination by domestic sewage disposed of through septic tanks and cesspools, hence nitrate contamination is a good indicator of the extent of groundwater contamination by sewage, in the absence of information about other sewage-related contaminants (e.g., fecal bacteria). The main health problem related to nitrates is methemoglobinemia in bottle-fed infants, although inconclusive studies also point out to gastric cancer risk in children and adults. Of 455 concession wells, only 228 are presently in use. Of the remaining wells, 117 had to be abandoned because of poor water quality, and 110 are out of service because of mechanical problems.[59] Projections of nitrate concentrations made by AA indicated that some 134 additional wells will have to be abandoned in the next 5 years. Information on concentration of nitrites (NO_2), which in small concentrations are much more dangerous than nitrates (NO_3), is not available. Nevertheless, it could be present in shallow heavily contaminated aquifers where anaerobic, reducing conditions may prevail.

59. Oral information received from Safege and Aguas Argentinas, September 1994.

2.45 The alternative solutions to the high nitrate concentrations found in groundwater are: (i) removal of nitrates from the contaminated well water; (ii) replacement of the well water by surface water or groundwater of good quality; and (iii) mixing of high-nitrate well water with surface water or low-nitrate well water; The first alternative - removal of nitrates by treatment - is expensive, since the use of membranes for ion exchange or reverse osmosis is the only technology presently available. Nevertheless, innovative technologies such as nitrate removal by biologic denitrification, are being studied in countries suffering from the same problem on a large scale (Germany, Israel), and a technological breakthrough might occur in the future.

2.46 The replacement of groundwater by surface water, wherever economically feasible and when no other alternative is feasible, may solve the high-nitrate problem relatively quickly. This alternative is envisaged for large areas in the western zone of GBA (Morón and Tres de Febrero), within the framework of the project financed by the IDB that would be constructed by AA in the next couple of years. In these areas, the problem of high nitrate concentration is combined with the even more serious problem of groundwater depletion and salinization because of overexploitation. While high nitrate concentrations alone would not justify abandoning groundwater as a source of supply, depletion and salinization justify it, since no economic solution is available to solve these problems.

2.47 AA has agreed with ETOSS that immediate priority will be given to replacement of wells with nitrate concentrations above 100 mg/l. This approach is in line with WHO policy of supporting the establishment of less restrictive provisional standards on a temporary basis, when it is clear that the levels recommended in the WHO Guidelines cannot be met and, at the same time, the provisional standard serves as a means of improving the drinking-water quality.[60] This so-called "nitrate plan", involves 8 projects for a population affected of some 30,000, or an immediate investment of US$30 million i.e. a per capita investment of US$100.[61] The cost to supply surface water to all the areas of the AA concession presently supplied by wells with nitrate concentrations above 50 mg/l is estimated at about US$80 million.

2.48 Mixing of high-nitrate well water with surface water or with low-nitrate groundwater can be the most attractive solution to the nitrate problem, where feasible, as it would permit the continued use of the groundwater aquifer. It would involve additional investments in distribution network and mixing reservoirs, which are site specific. Such mixing of two water sources is unavoidable in some expansion areas that would otherwise receive water from wells that may contain high nitrate concentrations. A pre-requisite to implementing such a solution is a comprehensive groundwater study of the area, by means of observation wells, combined with geophysical investigation, and systematic monitoring of the numerous individual and public wells operating in the area.

Sewage Treatment and Disposal

2.49 The release of untreated sewage into surface water has three main consequences of environmental concern. First, the presence of pathogens in sewage leads to biological contamination of the receiving water requiring closure of beaches and endangering drinking water sources. Second, sewage has high oxygen demand and reduces dissolved oxygen in the receiving water. Depending on the BOD concentration, aquatic life may suffer and

60. Dennis B. Warner, Hend Galai-Gorchev and Richard Helmer: "The Establishment and Interpretation of WHO Guidelines for Drinking Water Quality", World Health Organization, Geneva, paper Presented at the Annual Conference of the American Water Works Association, New York, 20-24 June 1994.

61. Aguas Argentinas: "Servicio de Agua - Proyecto de Sustitución de Agua con Nitratos: Actualización a mayo de 1994, 15 de junio de 1994.

objectionable odors may be created. Third, sewage contains inorganic nutrients (nitrate and phosphate) which promote plant and algae growth. Algae may reduce aesthetic value of waters, poison cattle, clog filtration units and increase water treatment costs.

2.50 Currently, only few cities have sewerage treatment plants (i.e. Mendoza, Córdoba); while the other cities release their raw sewage into the local waterbodies (i.e. Rosario, Buenos Aires, La Plata). Most of the sewage produced in GBA is discharged without any prior treatment directly into the Río de la Plata through a 2.5 km outfall in Berazategui, or indirectly via its tributaries, mostly the Reconquista and Riachuelo rivers. Currently, the sewage system of GBA is estimated to carry 25 m^3/s of untreated effluent into the Río de la Plata, which has a total flow of around 30,000m^3/s. At present, only some 5% of the sewage is treated (at secondary level).

2.51 Wastewater treatment increases the cost of sanitation services and competes for resources with the expansion of such services.[62] The desirability of wastewater treatment depends on the receiving water body and downstream usage of the water. In most inland locations, the release of untreated sewage leads to unacceptable costs leaving no doubt about the need for sewage treatment. For example, the Lago San Roque (the main source of water for the city of Córdoba) is already in an advanced state of eutrophication, has lost its recreational potential and is creating serious difficulties at the Córdoba main water treatment plant, because of the presence of large concentrations of algae in the lake water.

2.52 On the other hand, the large dilution and purification capacity of the Río de la Plata offers the opportunity for cheap disposal of sewage from AMBA. Despite the large quantity of untreated sewage released into the Río de la Plata, pollution is localized, and the costs of pollution from these discharges appear to be limited. However, contamination is of concern, mostly because of the aesthetic and bacteriological contamination of the river shore, which impairs its use for recreation. The problem is exacerbated by the proximity of water intakes to the sewerage discharge outlets and by unfavorable river flow patterns. Under certain flow and tide conditions, contamination by untreated wastewater discharged into the Ro de la Plata upstream or even downstream the water intakes may endanger the GBA water supply system, as well as the La Plata water supply system.

2.53 The AA concession contract stipulates the construction within five years (by 1998) of a large primary treatment plant prior to discharge into the Río de la Plata, as well as several small secondary treatment plants prior to discharge into the Reconquista and Riachuelo. The primary treatment plant would be upgraded to secondary-level treatment 10 years later (by 2008). However, AA has recently presented to ETOSS a request to modify these contractual requirements. Instead of primary treatment by the end of the fifth year, AA is proposing to discharge the raw sewage through an extended outfall into the river, after the removal of large solids. The request is based on: (a) water quality analysis carried out during 1994 which shows that the environmental impact of raw sewage disposal into the Río de la Plata is very moderate, due to the self-purification capacity of the river, and (b) Argentina's participation in the Basel Convention, since 1992, which bans the disposal of hazardous wastes into the sea, which closes off the option of disposing sewage sludge from the treatment plant in the sea, as had been envisaged. Given the above, careful analysis will be required to determine whether the requirements of the concession contract are desirable or should be renegotiated.

62. The required investments for sewage treatment are estimated at $96 per capita or $9.6 annually. This cost adds about 7-15% to the total cost of urban water supply and sewage supply (capital and operating costs). This figure, however, excludes operation costs for the sewage treatment facilities.

Recommendations

2.54 *Regulatory Incentives for Service Expansion.* The following recommendations are made for improving service providers' incentives to serve all customers with willingness-to-pay higher than total service costs (investment and operating costs):

(a) undertaking a comprehensive review of the present tariff system, with the objective of simplifying the intricate formula for unmetered consumption, and, at the same time, creating the necessary incentives for the installation of meters and the application of the rates based on metered consumption. The feasibility of overt, direct subsidies to the poor, instead of the present covert system of cross subsidies among consumers, should be included in this study.

(b) renegotiation of the concession contract to include a new tariff formula that raises tariffs for new customers to long-run marginal costs. AA would pay a charge for the use of existing infrastructure that would leave its current financial position unchanged;

(c) allowing AA to be compensated for the value of its investments at the expiration of the concession;

(d) improving the financial position of utilities outside of GBA and letting them charge tariffs sufficient for financial viability; and

(e) letting utilities offer wider financing options for connection charges.

2.55 *Service Cost Reductions.* Water and sanitation services can be made more affordable to a larger share of the population through lower costs through the following measures:

(a) undertaking a comprehensive demand management plan in order to reduce water consumption, water demand and sewage volumes produced. Optimization of the use of water in the existing system will allow expansion of service to be carried out at a lower cost.

(b) commercialization of services following the example of GBA and Corrientes;

(c) offering low cost intermediate solutions where these are the most economical option;

(d) introducing metering of all consumers to reduce unbilled consumption;

(e) regularizing existing clandestine connections to water and sewage networks; and

(f) determining the need for sewage treatment based on a comparison of costs and benefits and including in the evaluation options such as the extended ocean outfall as an alternative to secondary treatment at Berazategui.

2.56 *Improving Access to the Poor.* The following measures could improve the delivery of services to families which cannot afford to pay even the cost of simple low-cost systems:

(a) clarifying the implications of the AA concession contract for low-income consumers which are not yet served;

(b) letting utilities bill a block rate charge for low-income consumers to the government. In the case of GBA, this subsidy could be paid from the new charge for the existing infrastructure (see above);

(c) investigating the technical and economic feasibility of "simplified sewerage" and "solids-free sewerage" for sewage collection in low-income communities;

(d) investigating the technical and economic feasibility of the innovative UASB (upflow anaerobic sludge blanket) wastewater treatment process in a pilot under local climatic conditions, for the treatment of liquid sludge from septic tanks transported by maintenance trucks, as well as for high-strength organic industrial wastes; and

(e) investigating ways of stimulating and supporting, both technically and institutionally, the adoption of low-cost technologies.

2.57 *Improving Water Quality.* The management of water quality and water resources should be improved:

(a) modifying the current policy of giving lower priority to sewerage than to water supply, to avoid further deterioration of the groundwater quality.

(b) *Drinking-Water Quality.* In view of the foreseen difficulty to comply with the future turbidity standard of 1 NTU, plans should be prepared for upgrading the two existing surface water treatment plants. A comprehensive water quality monitoring program should be undertaken for the public wells that will continue to supply potable water for many years. Some monitoring should also be provided for the large number of individual wells operating in the area, whose quality is at present doubtful. Monitoring of the water quality in the distribution network should also be undertaken mainly to ensure adequate residual chlorine at all points of consumption.

(c) *Groundwater.* A comprehensive groundwater study of the area should be undertaken, by means of observation wells, combined with geophysical investigation, and systematic monitoring of the numerous individual and public wells operating in the area. The creation of a groundwater database will serve many useful purposes. Nitrite (NO_2) analyses should be carried out in some of the individual wells pumping from the Epipuelche aquifer in contaminated areas. The updated position of Argentine health authorities with respect to permissible nitrate and nitrite concentration should be clarified.

(d) *Conjunctive Use of Surface and Ground Water.* Conservation and rehabilitation of the Puelche groundwater aquifer should be maximized, to allow for its continuing use as an important source of drinking water, in conjunction with the surface water abundantly available in the area but whose supply involves higher investment costs.

(e) *Water Conservation and Wastewater Reuse.* The feasibility of introducing water-saving plumbing fixtures, and reusing treated effluent and sewage sludge for industrial uses, landscape irrigation, and as agricultural fertilizer, should be investigated.

2.58 *Sewage Treatment.* To provide a basis for the development of a long-term solution to the environmental degradation of the Río de la Plata near the coastal area of the AMBA, a thorough environmental assessment is needed to determine the impact of the discharge of raw sewage into the river. The assessment will need to take into account both bacteriological and aesthetic considerations, as they affect the multiple uses of the river as a source of water for the city's water system intakes, a locus of recreation, as well as an ecological resource. The study should also serve to establish the environmental norms that should be met in different sections of the river.

2.59 The proposed assessment would require the following inputs:

(a) a database on all contaminants in the Río de la Plata, in sufficient spatial detail to identify the discharges of the Reconquista and Riachuelo rivers and other creeks and canals in the area. The study should establish a permanent monitoring systems which should provide immediate information on environmental changes in specific locations in the river.

(b) a mathematical model to simulate the assimilative capacity of the river under actual conditions and under alternative scenarios. In addition to enabling the selection of the best combination of treatment level and outfall length, such a model would also enable selecting the best location of the water intakes so as to minimize the danger of contamination from sewage discharges.

3. Managing Industrial Pollution

Problems and Current Policies

3.1 Industrial discharges are a major source of air, water and solid waste pollution in Argentina. In principle, these discharges are regulated by the provinces through a framework of zoning regulations and industrial operating permits. Enforcement is largely delegated to the municipalities, though the courts in some provinces have been extending their powers to inter-vene, even where the legal foundation for their actions is disputed. A 1992 national law assigns responsibility for the regulation of hazardous wastes to SERNAH, but this arrangement has not been endorsed by most provinces and compliance with the new law seems to be very patchy.

3.2 Over 60% of all industrial production is concentrated in the *Area Metropolitana de Buenos Aires (AMBA)*. As noted before, in most parts of the country, air pollution from industrial sources is regarded as a less serious concern. On the other hand, industrial sources are responsible for a substantial proportion of wastewater discharges which are responsible for the poor quality of rivers and groundwater in the metropolitan area. The problem of the disposal of hazardous wastes is also largely an industrial one which is greatly exacerbated by weaknesses in the regulatory framework and by the absence of any approved disposal facility.

3.3 This chapter will focus particularly on water pollution from manufacturing industry in the AMBA area, both because of its importance in the overall national picture and because it is better documented than industrial pollution elsewhere. Visits to Córdoba, Rosario, and Mendoza suggest that the picture that emerges for AMBA is typical or even worse than that for other cities. Issues that are specific to individual industries --for example, petroleum production and refining, electricity, and mining-- are discussed later in the chapter.

Manufacturing Industry in Buenos Aires

3.4 In 1985 the National Economic Census reported that there were about 44,000 industrial establishments in AMBA. Following previous trends, this number had probably declined to about 35,000 by 1994. Most of them are small so that less than 1,000 establishments account for 90% of all discharges by volume. In 1993 SERNAH carried out a survey of industrial water discharges in the area under its jurisdiction. It was intended to provide complete coverage of all medium and large establishments, but the actual coverage is not known. However, data was received on nearly 9400 point emission sources in 4960 establishments with total discharges of 264,500 m^3/day.[53]

3.5 Since SERNAH's survey covers about one-seventh of all establishments, one could estimate total discharges as 1.9 million m^3/day, which is a frequently quoted figure. However, allowing for both the underrepresentation of small establishments and the likelihood that the response rate was biased in favor of establishments which have some kind of water treatment, an estimate of total discharges would better be based on employment figures. Total employment in the establishments covered by the SERNAH survey amounted to 233,000 out of an estimated industrial employment in AMBA of 1.1 million. As an approximate adjustment to obtain broad estimates for the whole population of industrial establishments the sample estimates may be multiplied by a factor of 4 for AMBA, and by a factor of 2 for GBA (the AA concession area).

3.6 As shown in Table 11, the food processing, textiles, beverages, and paper sectors

53. The largest individual sources of wastewater in the industrial sector were discharges of cooling water from power plants which have been excluded from this analysis since they contain very low levels of pollution.

Table 11: Percentage of Discharges Treated to Different Levels by Sector

Sector	Percentage of wastewater discharges receiving treatment :				Total volume of wastewater discharges thousand m^3/day*
	Pre-treated	Primary mechanical	Primary chemical	Secondary	
Chemicals	44	51	46	17	1.0
Beverages	19	17	15	17	35.6
Food	48	69	26	25	57.9
Metals/ machinery	57	70	46	40	28.1
Paper	12	53	71	5	30.5
Textiles	49	93	47	21	42.8
Other	44	53	27	18	68.8
All	40	58	36	21	264.5

* Establishments covered by SERNAH survey.

each discharged at least 30,000 m^3 per day and accounted between them for 63% of total discharges from manufacturing. The metal products & machinery sector stands out as having consistently a higher proportion of its discharges receiving treatment. About 36% of all manufacturing wastewater is discharged to sewers, 39% to nearby rivers and streams, and 21% to stormwater drains (which mostly flow into rivers or streams). Sewer discharges are substantially less likely to have been treated in any way than discharges to other destinations. Discharges from sources with low volumes of wastewater—less than 1 m^3 per hour—are also much less likely to have been treated, than discharges from larger volume sources. This may either (a) be a consequence of economies of scale in wastewater treatment which can mean that the unit cost of treating low volumes of effluent is disproportionately high, or (b) reflect the judgement of enterprises that they can discharge low volumes of untreated effluents without serious risk of detection or penalties.

3.7 There are regulations governing the maximum contamination of wastewater discharged by industrial and similar sources to municipal sewers (see Table 13). Thus, discharges to municipal sewers should be (pre-)treated to meet these standards. It appears that these regulations have rarely been enforced as there was little attempt to monitor the quality of such discharges. However, under the operating license granted to Aguas Argentinas, the utility is required to monitor the quality of sewer discharges from industrial and other establishments and to notify SERNAH where the discharge standards are being violated. This monitoring exercise has been underway since May 1993 and the results show widespread violations of the discharge standards.

3.8 Aguas Argentinas provided summary data for 1140 inspections carried out between May 1993 and Sept. 1994—Table 12. Only 167 establishments met the sewer discharge regulations on all criteria. Of the sectors

Table 12: Monitoring Results for Industrial Discharges to Aguas Argentinas Sewers

Industry	Sample	Number in violation of discharge standards	Numbers exceeding discharge standards for specific pollutants				
			TSS	BOD	COD	Detergent	Chrom.
Meat packing	155	144 (93%)	117	98	126	22	0
Other foods	113	93 (82%)	59	50	71	24	0
Textiles	236	210 (89%)	111	80	75	142	7
Tanneries	67	62 (93%)	36	29	45	3	54
Soaps, etc	16	14 (88%)	14	5	10	4	0
Other chemicals	44	36 (82%)	14	17	21	9	7
Metals/ machinery	91	61 (67%)	11	2	13	3	38
Others	41	29 (71%)	2	16	4	8	

Note: BOD - Biological Oxygen Demand
COD - Chemical Oxygen Demand
TSS - Total Suspended Substances
Source: Aguas Argentinas

separately identified, the sector with the highest proportion of sources which complied with the regulations was the metal products and machinery sector (33%). Though outside the manufacturing sector, automobile service stations were the worst offenders with respect to violation of standards for hydrocarbons and lead, highlighting the negligent handling and disposal of gasoline and motor oils as a significant source of water pollution.

3.9 Average concentrations for sewer discharges that violated the standards are shown by sector for the main water pollutants in Table 13. Taken together with the data in Table 12 this indicates, for example, 98 out of 155 establishments in the meat packing sector violated the BOD sewer discharge standard of 200 mg/l and that the average concentration of BOD in the discharges from these 98 establishments was 2020 mg/l. These average concentrations are several times the sewer discharge standards for almost all sectors and pollutants.

3.10 In the SERNAH survey, establishments reported that 19% of wastewater discharged to sewers was pre-treated, 34% received primary mechanical treatment, and 21% received primary chemical treatment. The purpose of treating industrial wastewater before it is discharged to sewers should be to meet sewer discharge standards. If the reported pre-treatment or primary treatment operations were properly carried out, it is very unlikely that over 85% of all establishments would violate the sewer discharge

Table 13: Average Pollutant Concentrations for Industrial Discharges to sewers which Violate Discharge Standards

Industry	Average pollutant concentrations for emissions which violate specific sewer discharge standards (mg/l):				
	TSS	BOD	COD	Detergent	Chromium
Meat packing	752	2020	461	30.1	
Other foods	826	1712	664	19.8	
Textiles	307	1023	286	21.0	0.33
Tanneries	526	1050	447	6.1	36.80
Soaps, etc	1837	3866	675	217.9	
Other chemicals	331	1171	471	12.1	0.86
Metals/ machinery	451	625	416		46.00
Others	1216	658	344	9.5	5.15
Discharge standards (mg/l)	100	200	80	5	0.2

Source: Staff estimates based on Aguas Argentinas data.

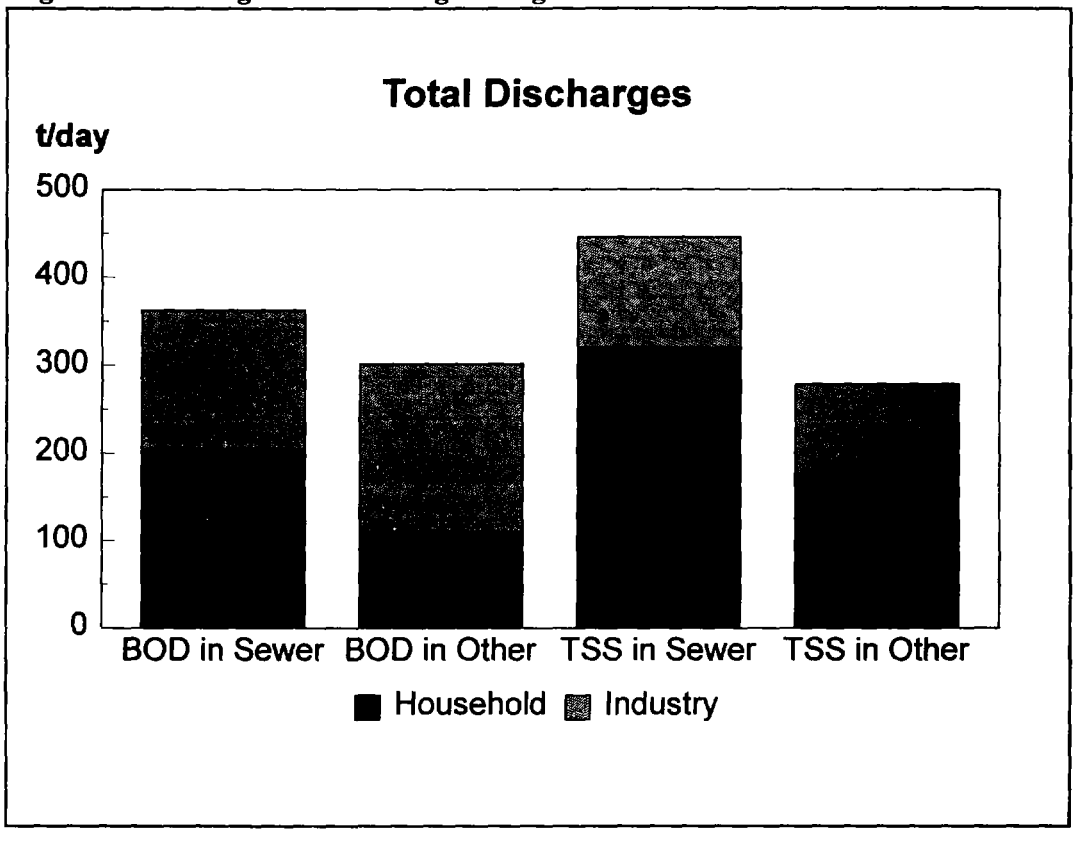
standards with high average levels of concentration of the main pollutants. The inference must be that some—perhaps many—of the treatment facilities are not being operated in a manner that permits them to achieve their design levels of efficiency in removing pollutants. Therefore, simple changes in the management and operation of existing industrial wastewater treatment facilities may permit significant or even large reductions in the overall levels of water pollution caused by industrial emissions.

3.11 Assuming that the average concentrations reported by Aguas Argentinas in discharges which violate the sewer discharge standards are typical of pollution concentrations in untreated wastewater, it is possible to make some tentative estimates of the pollution loads discharged by manufacturing industry in AMBA. Using data on pollution removal rates for standard technologies taken from the Industrial Pollution Control software developed by the World Bank and WHO, and assuming that the existing waste treatment facilities are operating properly, the total load of BOD discharges from the establishments covered by the SERNAH survey is about 165 tons per day. If it is assumed that the SERNAH survey sample is equivalent to one-half of industrial effluents in the AA concession area, total discharges of BOD in industrial wastewater amount to 330 tons per day or about the same as discharges of BOD from households.[54] Similar calculations indicate that industrial discharges of TSS amount to about 220 tons per day, or about half the discharges of TSS from all households. Even if the multiplier used to scale up the SERNAH survey results is too high, it is clear that industrial discharges of BOD are at least as important as household discharges in determining the total load of BOD pollution in the metropolitan area (see Figure 7).

3.12 The reason for highlighting these figures is that Aguas Argentinas is being required to

54. The 9 million households in AA's concession area are estimated to produce about 315 tons per day of BOD, based on average production of about 35 tons per day/million households.

Figure 7: Discharges within the Aguas Argentinas Concession



make a very large investment—about $900 million—to provide primary and secondary treatment all of the wastewater that it collects, which is currently discharged with little or no treatment into the Río de la Plata. The question that must, therefore, arise is whether these resources are being directed at the right problem. In terms of immediate environmental impact, the primary costs of water pollution are emissions of BOD and other industrial pollutants (such as detergents, hydrocarbons and heavy metals) directly to rivers/streams, stormwater drains or groundwater drainage. Since industrial establishments are just as important sources of these pollutants as households, it is useful to compare the projected sewage treatment investments with alternative strategies to reduce industrial pollution.

Industrial Pollution Control Scenarios

3.13 The potential pollution loads and investment costs of alternative industrial pollution control levels were estimated for (i) a "worst case" scenario in which existing treatment facilities are completely ineffective, (ii) a "current" scenario on the assumption that the existing treatment facilities operate to reasonable design specifications, (iii) an "A1" scenario to illustrate the reductions in loads that might be achieved if all industrial establishments were to install primary treatment, and (iv) an "A2" scenario to illustrate the case where both primary and secondary treatment is used. The estimates in Table 14 and Table 15 show the range of BOD and TSS discharges to different destinations under the alternative scenarios.

3.14 The difference between the worst case and the current scenarios (particularly obvious for BOD discharged from the food processing

Table 14: BOD Discharges by Sector under Alternative Discharge Treatment Standards

Sector	Destination Scenario. Volume of BOD discharged to destination under scenario (tons per day):*											
	Sewers				Stormwater drain				River/stream			
	Worst	Current	A1	A2	Worst	Current	A1	A2	Worst	Current	A1	A2
Chemicals	1	0	0	0	0	0	0	0	0	0	0	0
Beverage	17	17	14	2	0	0	0	0	6	2	5	1
Food	21	15	3	1	12	3	2	0	82	18	10	3
Metals/ machinery	6	5	2	1	1	1	0	0	10	2	3	1
Paper	4	3	2	1	14	9	8	4	3	2	2	1
Textiles	21	15	13	1	14	7	8	1	8	2	5	0
Other	32	24	17	3	39	30	23	4	19	9	6	1
All	102	79	51	8	80	51	42	9	128	35	30	7

* From all establishments covered by the SERNAH survey. A1 = Primary (physical and chemical) treatment for all sources. A2 = Primary + secondary treatment for all sources.

and textiles sectors) demonstrates ample opportunities for reducing current emissions at almost no cost by enhancing the operation of existing treatment facilities. The 'A1' and 'A2' results show what might be achieved in future if (i) all industrial wastewater received primary physical and chemical treatment before being discharged (including pre-treatment where appropriate), and (ii) all industrial wastewater received both primary and secondary treatment before being discharged. Moving to uniform primary treatment would reduce total industrial discharges of BOD by 26% and of TSS by 68%. The impact on discharges to sewers would be even larger—a reduction of 35% for BOD and one of 72% for TSS. This would represent a fall of about 15% in the overall BOD load to sewers from industry and households and one of 20% for the overall TSS load. Going further to require uniform secondary treatment would reduce total industrial discharges of BOD and TSS to 15% and 19% of their current levels. As for primary treatment, the impact of this requirement on discharges to sewers would be even larger. The overall BOD load to sewers from industry and households would be reduced by 40% and the overall TSS load by 25% by such a measure. Thus, the sizing of AA's planned primary and secondary treatment facilities could be substantially adjusted if a major effort were made to reduce the pollution loads discharged by industrial establishments to sewers.

3.15 It would, of course, not make sense or be possible to impose uniform treatment requirements on all industrial wastewater discharges. However, as has been discussed, most of the reductions that have been estimated can be achieved by concentrating efforts on establishments with relatively high volume discharges.[55] Sources discharging less than 5 m^3 per hour are responsible for only 15% of total industrial wastewater discharges. An appropriate strategy might be to require all establishments discharging more than 5 m^3 per hour to install (and operate !) secondary treatment facilities, while establishments with discharges in the range 1-5 m^3 per hour might be required to install some kind of primary treatment.

55. For example, out of about 4,200 sites that have been identified as potential polluters in the Reconquista river basin, 280 sites contribute 89 percent of BOD emissions. In one Tigre, 12 out of 800 industrial establishments contribute 90 percent of the emissions. Half of these 12 establishments have wastewater treatment facilities which are either out of operation or operate at low efficiency. (Inter-American Development Bank, Propuesta de Prestamo, Saneamiento Ambiental y Control de Inundaciones en la Cuence del Rio Reconquista)

Table 15: TSS Discharges by Sector under Alternative Discharge Treatment Standards

Sector	Destination Scenario. Volume of TSS discharged to destination under scenario (tons per day):*											
	Sewers				Stormwater drain				River/stream			
	Worst	Current	A1	A2	Worst	Current	A1	A2	Worst	Current	A1	A2
Chemicals	0	0	0	0	0	0	0	0	0	0	0	0
Beverage	31	31	12	3	1	0	0	0	11	4	4	1
Food	10	5	0	0	5	1	0	0	34	6	2	2
Metals/ machinery	4	3	1	1	1	1	0	0	7	1	1	1
Paper	7	7	1	1	25	5	3	3	5	2	1	1
Textiles	6	3	1	0	4	2	1	0	3	0	0	0
Other	21	14	3	2	19	13	3	2	29	13	4	4
All	79	63	17	8	56	21	7	5	89	27	12	8

* From all establishments covered by the SERNAH survey. A1 = Primary (physical and chemical) treatment for all sources. A2 = Primary + secondary treatment for all sources.

3.16 The final question is whether the cost of such a strategy is manageable, assuming that it would be implemented over a period of perhaps 10 years, thus giving enterprises the opportunity to phase the necessary investment along with other investments in plant expansion or modifications. Table 16 provides indicative estimates of the capital cost of implementing the A1 and A2 treatment requirements by sector and discharge destination. Uniform primary treatment would cost about $95 million for all establishments in the survey—ie. about $190 million for the whole Aguas Argentinas service area, of which $100 million would be required to treat discharges to sewers. Uniform secondary treatment would cost about $200 million for all establishments in the survey or about $400 million for the whole Aguas Argentinas service area, of which $230 million would be required to treat discharges to sewers. Comparing these costs with the Aguas Argentinas investment plan and the potential reductions in total loads on treatment plants, there are strong grounds for believing that the strategy outlined in the previous paragraph would be a much less expensive way of reducing the damage caused by water pollution in AMBA than the one that is currently being followed. More detailed work will be required to generate reliable estimates of the magnitude of the potential savings.

3.17 The above analysis could also be used to develop a least cost strategy for the clean up of the most polluted rivers in the country: the Río Matanza/Riachuelo and the Río Reconquista. Existing proposals to carry out a full cleanup program aimed at restoring the natural environment of these river basins could require aggregate investments in excess of US$1 billion. The calculations above suggest that a more gradual approach focussed on reducing pollution at the source would achieve significant environmental improvements at a much lower cost.

Implementing a Strategy for Industrial Pollution Management

3.18 While there may be substantial cost savings to be made by pursuing a strategy of decentralized pollution control, as outlined above, there are also good reasons to be concerned about its feasibility. The past and current record of enterprises in treating their wastewater is poor, despite both legislation and exhortation. What changes, therefore, will be required in order to achieve compliance with environmental

Table 16: Investment Costs for Treatment of All Discharges to Different Destinations by Sector

Sector	Investment cost in $ million*							
	Primary treatment (A1) of discharges to:				Primary and secondary treatment (A2) of discharges to:			
	Sewers	Storm-water drain	River/ stream	All	Sewers	Storm-water drain	River/ stream	All
Chemicals	0	0	0	1	1	0	0	2
Beverage	5	0	1	7	21	1	3	26
Food	15	3	13	33	21	4	14	40
Metals/ machinery	9	1	2	14	24	3	5	36
Paper	5	3	2	11	6	5	2	14
Textiles	6	2	1	9	11	5	2	18
Other	11	3	3	20	32	9	14	63
All	51	12	23	95	115	26	39	198

* For all establishments covered by the SERNAH survey.

regulations that have been widely ignored up to now?

3.19 The key issues are incentives and information. The water bodies' capacity to absorb water pollution has been treated as a free resource—both by businesses and the authorities—so that there has been little reason for the treatment of wastewater discharges. Enforcement of regulations governing discharges to sewers or other destinations has been almost non-existent, while there was no organization that had a substantial interest in monitoring or controlling the quality of such discharges. The inward-looking character of Argentina's past economic policies meant that most businesses were relatively isolated from both (a) the external economic pressures that have stimulated the adoption of new practices and/or technologies which reduce both costs and pollution and (b) the ferment of discussion and publicity about environmental issues and technologies that has alerted their peers in North America and Europe to ways of improving their performance.

3.20 The changes that have been taking place in Argentina's economy over the past 5 years have had or will have their impact on both of these issues. Economic stabilization and the prospect of sustained economic growth have stimulated a groundswell of public concern about particular environmental issues—eg. hazardous wastes—and the potential impact of rapid industrial expansion on the quality of the environment. Liberalization of trade and capital flows has opened up new horizons for many businesses, which are beginning to recognize that they will have to improve both their economic and their environmental performance. The crucial lesson which is gradually being learnt is that with modern technologies there may be no significant trade-off between these two dimensions of industrial performance. For most industrial plants good environmental

Box 8: The Case of the Paper and Pulp Industry

Argentina's pulp and paper industry provides a classic example of the challenge and opportunities associated with the liberalization of trade. From one perspective it is an industry in deep crisis with too many inefficient, uncompetitive plants which have an extremely poor environmental record. On the other hand, there are a number of firms which are able to compete successfully on local and world markets and whose environmental performance is exemplary.

The industry's basic problem is that its plants are old and too small - the average capacity of both pulp and paper plants is less than 30% of the equivalent averages for Brazil and Chile. Throughout the 1970s and 1980s the industry enjoyed a protected market, so that few firms invested to adopt modern pulp and paper technologies. The leading firms in 1970 - Celulosa Argentina, Ledesma, Papel Misionera - have been largely displaced by new entrants - Alto Parana, Papel Prensa, and Papel Tucuman. It is these new firms that have been responsible for the substantial growth in production and decline in imports from 1970 to 1990. Subsequent trade liberalization has put extreme pressure on most of the older plants - especially those producing paper - as a result of competition from Brazilian imports and the depressed state of the world pulp and paper market during the early 1990s. Paper imports increased from 5% of the domestic market in 1990 to 33% in 1993. Only Alto Parana, which only produces kraft pulp and much of whose output is exported, has a plant of sufficient capacity to gain the full benefits of economies of scale and modern technology, though Papel Prensa and Papel Tucuman are reasonably placed, especially as paper producers.

The environmental performance of the older plants is largely deplorable. Many of the older paper plants are based in Gran Buenos Aires and discharge wastewater with only limited treatment. Their reliance upon outdated technology also means that they produce much greater volumes of wastes than do more modern plants. In 1992, the average level of BOD discharges was 24 kg/ton for paper and 32 kg/t for pulp, very similar to the averages for 1975 despite much better performance of Alto Parana and the other new entrants. The industry association AFCP has agreed a target average of 12-16 kg of BOD per ton to be achieved within 10 years. This will still be much higher than current standards for new plants in the US and Canada of 5.5-7.5 kg/t. By closing down old, uncompetitive, and heavily polluting plants - especially in the paper sector - it should be possible to reduce average emission of BOD per ton much more rapidly.

Alto Parana stands out for its environmental performance. At the beginning of the 1990s its emissions were as good or better than those from Scandinavian kraft pulp producers. Since then, it has invested to change its production process to rely more upon chlorine free bleaching, to reduce its wastewater discharges to match best practice in the industry, and to obtain ISO 14000 certification. The purpose of these changes has been to take advantage of the demand for "environmentally friendly" pulp in Germany and other North European markets. This is a clear case in which industrial restructuring brought about by trade liberalization should bring large environmental benefits.

Source: N. Bercovich and M. Chidiak, Reestructuración industrial y gestión ambiental en el sector de celulosa y papel en Argentina, Buenos Aires: Centro de investigación para la transformación, September 1994.

management is simply a manifestation of good industrial management. Thus, focusing on improving environmental performance may be a way of enhancing the operational and economic efficiency of plants or businesses.

3.21 The initial response of industrial enterprises to the new incentives and opportunities has been mixed. This reflects differences among them in their resources and opportunities. One important distinction is that between (a) large enterprises, typically with strong international links and relatively easy access to capital funds, and (b) medium and small enterprises with stronger roots in the domestic economy and a more limited involvement in international markets.

Large Enterprises

3.22 For the most part large enterprises recognize the need to improve their environmental performance and the general economic benefits that this will bring. They have access to the necessary management, technical and financial resources, so that the primary issue is one of establishing clear priorities and guidelines so that they can embark upon a

program of upgrading their facilities and performance. Some large enterprises have multinational owners which expect their subsidiaries to conform to standards of good environmental practice that ensure that local management is able and, indeed, required to adopt technologies and operating procedures that reflect the best experience of environmental management around the world. Others are shifting their focus from the domestic market to international opportunities as a result of Mercosur and the general thrust of trade liberalization. This has prompted them to assess and adjust their operations in order to reduce costs and, often as a side benefit, to improve their environmental performance. Those looking to European markets are interested in meeting the requirements of ISO standard 14000 on environmental management. Economic growth and a resurgence of investment in new plant should ensure a steady reduction in emissions as improved environmental technologies are embodied in new capital equipment.

3.23 Among the usual heavily polluting industries, the paper and pulp industry provides an interesting contrast in environmental performance—see Box 8. The largest pulp mill in Argentina is equipped with modern technology and has been steadily improving its environmental performance in order to expand its position in environmentally-sensitive markets. Other pulp mills are older, less oriented to international markets and have a much worse environmental record. They are coming under increasing pressure to rationalize production and facilities. The result is likely to be the emergence of a more efficient, though perhaps smaller, industry with a much higher level of environmental performance. A very similar process has been occurring in the steel industry with the additional element of privatization.

3.24 Another major problem area is the oil refining and petrochemical sector—see Box 9. While the recent privatization of YPF did not address the company's environmental problems, there are good reasons to expect that changes in incentives combined with improved access to capital markets following privatization should bring a gradual improvement in the company's environmental performance. A significant component of the environmental damage caused by refineries and petrochemical plants is the consequence of poor maintenance and management of equipment and operating processes and represents a loss of valuable feedstocks or products. The economic payback to addressing these problems is large, so that well-managed private firms have a substantial incentive to reduce leaks, recycle water, recover materials and adopt other changes which will mitigate environmental damage. Initial attention should focus on reducing current levels of emissions rather than on cleaning up the legacy of damage caused by past emissions waste disposal. In due course, a major clean-up effort will be required, but at present there is no satisfactory basis for establishing priorities or for allocating the liability for the costs involved.

3.25 The role of the environmental authorities with respect to large enterprises is to establish a clear framework of incentives and regulations that would reinforce the economic and other internal pressures to improve environmental performance. There may be differences between environmental priorities established by reference to the internal concerns of management, markets, and financial returns and those reflecting broader national or local considerations. In the case of major emission sources such as the La Plata refinery, the provincial authorities—with assistance from SERNAH—must sit down with the management and negotiate an agreement on bringing the plant into compliance with local and national environmental regulations. This agreement should cover: (a) the initial priorities to be addressed by plant management; (b) the relevant standards for air, wastewater and solid waste emissions that will apply in the longer term to the plant as a whole and immediately to any new units within the plant; (c) a schedule for bringing the plant into compliance with the standards over a period of, say, 6-8 years plus any explicit exemptions from this compliance

Table 17: Selected Environmental Impacts of Medium and Small Enterprises

Nature of impact	Source of impact	Technical alternatives
Liquid effluents	- Slaughterhouses, cold storage, and meat processing - Tanning and leather - Metal finishing and electroplating - Light chemicals - Dairy products	- Good housekeeping - Enhanced industrial efficiency - Waste minimization - Recycling and reuse of waste as a byproduct - On-site waste treatment - coagulation, precipitation, sedimentation, filtration, biological treatment - Collective treatment facilities
Solid, toxic and hazardous wastes	- Metal finishing and electroplating - Automotive parts - Light chemicals	- Waste minimization and recovery - Solid waste disposal in special land fills after neutralization - Hazardous and toxic waste incineration

requirement; and (d) arrangements for continuous or intermittent monitoring of the performance of the plant as well as for reviewing the agreement after some appropriate period. Such agreements should be backed up by clear economic incentives including charges for certain types of air emissions as well as wastewater discharges and solid waste disposal. Such charges should vary according to the associated pollution loads and should include stiff additional penalties for violating the provisions of the agreement.

Medium and Small Enterprises

3.26 The primary concerns about industrial pollution in Buenos Aires, Córdoba, Rosario and other metropolitan areas focus on the liquid and solid wastes from a limited number of industries dominated by medium and small enterprises. The main offenders are listed in Table 17. These enterprises, like their larger brethren, are facing major challenges as a consequence of the economic changes that are underway. However, they are less likely to regard such changes as positive and are less well-placed in terms of access to capital, technology and markets to take advantage of the new opportunities. Some, perhaps even many, are likely to fail or contract drastically while a few will grow and thrive.

3.27 In these circumstances, medium and small enterprises tend to resist the pressure to improve their environmental performance, fearing that this will increase their costs and erode their competitive position—either vis-a-vis other domestic firms or against (often larger) foreign firms in both domestic and international markets. This strong preference for continuing to benefit from an environmental 'free ride' has to be overcome by the environmental authorities relying upon a combination of education and information, incentives and political will. The last is crucial because firms cannot be expected to give up access to a free resource—the *de-facto* right to dump wastes without regard for the costs imposed on the rest of the community—without a struggle and a clear commitment to ensure that the benefits of economic growth are reflected in improvements in environmental quality for the general population.

3.28 At the same time it must be emphasized that the costs involved are likely to be small in total and may, indeed, even be zero for many firms. Just as for large enterprises, Table 17 outlines a number of alternatives for dealing with liquid and solid wastes which will reduce the operating costs of enterprises though some transitional costs of changes in process and

Box 9: Petroleum Sector Pollution Problems

The petroleum sector is one of the major sources of environmental pollution. In the past, the large national state enterprises concerned with exploitation of major energy resources and infrastructure development were not too mindful of minimizing their operations' harmful effect on the environment. YPF's neglect caused persistent emissions, some with toxic substances, resulting in soil, water, and air damage. Its oil fields are scarred with blackened streams produced by equipment leaks, and with ponds with solidified petroleum caused by inadequate separation of water from the oil produced.

Drilling and exploitation of wells produces large quantities of water that has extremely high salinity and poses a serious threat to the environment. Currently YPF reinjects this water or discharges it into pits, ponds, and separating lagoons, and mostly into rivers. Environmental contamination from this source is particularly serious at Puerto Hernandez, Neuquen, where about 30,000m^3/day are discharged into an important source of drinking water supply for over 50,000 people in Rio Negro Province. The mud from drilling operations contain lead and toxic components. Close to 200,000 abandoned pits and ponds exist in YPF's major oil fields. These pits and ponds present risks to soil and groundwater and reduce land value. Pits and ponds also pose danger to cattle, birds, and other wildlife. Over 500,000km^2 have been impacted by oil exploration and exploitation. There are some 20,000km of pipelines, many of which are inadequately maintained and present a risk of oil spillage and soil contamination. It is estimated that about 5,000 abandoned oil wells have not been properly sealed leading to continuing emission of gases. Environmental pollution from refineries is most serious in La Plata. The La Plata refinery has had high energy consumption and hydrocarbon loss causing spillage and seepage which has contaminated the site and surrounding canals.

More recently, rules for operations in the hydrocarbon sector have been improved significantly. At the provincial level, there is growing concern about pollution problems for the petroleum sector, and provincial authorities have more frequently imposed fines for environmental violations. Increased environmental awareness of international oil companies has also contributed to improvements. National regulation from 1992 sets out suitable requirements for all aspects of petroleum exploration, exploitation, production and refining. It prescribes environmental impact assessments, mandates the integration of protective measures into the planning of petroleum projects, and defines appropriate criteria for reducing air emissions, water effluent and soil contamination. It authorizes the Energy Secretary to apply these considerations in approvals of sector licensing and operations. The Secretary is authorized to develop environmental operating guidelines.

In 1993, a project for the mitigation of environmental impacts of the oil industry was prepared for World Bank financing. The investment cost of environmental mitigation at the La Plata Refinery was estimated at US$265 million. Improvements at the YPF product terminal would have cost US$195 million. The cost of cleanup of the oilfields in three areas was estimated at US$32 million. The project was intended to cleanup the operations of YPF before its stock would be offered for sale on the international capital markets. After the sale of YPF stocks was advanced, the new owners did not pursue this project.

management may be involved. Investments in waste minimization and good housekeeping—including the segregation of pollutants from different processes, recovery and recycling of material inputs, marketing of by-products that are currently dumped—are generally inexpensive and can be implemented by any industry—see Box 10 and Box 11 for examples. Thus, a campaign of education and technical assistance to promote improved maintenance and operating practices, good housekeeping and waste minimization should yield substantial public and private benefits.

3.29 Such a campaign must be backed up by appropriate incentives to encourage the proper disposal of wastewater and solid wastes. As an illustration, an effort to minimize water use and to reduce the pollution in discharges has been started in Buenos Aires for the leather tanning industry. This has traditionally relied upon well water, whose marginal cost was zero once the well was sunk, and was able to discharge their wastewater into sewers without charge since the cost of water and sewage services was recovered from charges linked to water consumption rather than sewage discharges. Now, Aguas Argentinas is permitted to charge for sewage services and is

Box 10: Small and Medium Enterprises (I): The Leather Tanning Industry

Leather Tanning

Argentina has one the largest tanning industries in the world with more than 400 firms, most of them based in Gran Buenos Aires. There are two cooperatives based in the metropolitan area: (a) TELIPA with 30 members representing 25-30% of the industry's output, most of them based in Avellaneda partido; and (b) ACUBA with 140 smaller firms accounting for 15% of output, almost all of them located in Lanus Partido. The industry is classified as 'heavily polluting' because its wastewater discharges can contain large amounts of chromium, BOD, suspended solids, oil & grease, sulfides and bacterial organisms. Most of the members of TELIPA and about one-quarter of the members of ACUBA discharge their spent chromium-bearing effluent to sewers, stormwater drains or streams without chromium treatment. The remainder use a communal treatment facility or do not rely upon chromium in their tanning operations. Apart from some removal of solids there is little other treatment of the industry's wastewater before it is discharged.

Firms which discharge to Aguas Argentina's sewer lines or to stormwater drains maintained by AGOSBA are subject to discharge fees which are usually calculated on the basis of gross water consumption. Fees of $5-6,000 per month are not unusual. Inspections are typically carried out every 2-3 months and some testing of wastewater quality if carried out, but no firm seems to have been penalized for failing to meet discharge regulations in the recent past.

ACUBA has begun operating a communal treatment facility in Lanus partido. Currently this only deals with chromium recovery, but there are plans for a wastewater treatment plant (90% of the civil works have been completed) and a network of wastewater collectors to connect tanning plants to the communal facility. TELIPA is planning a similar facility in Avellaneda together with the relocation of its members to a contiguous industrial park.

Liquid wastes from the industry could be reduced by: (a) segregation of wastewater prior to separate handling of spent chromium-bearing liquors, sulfide-bearing wastewater, non-contract process waters, and other process wastewaters; (b) process modifications to reduce the volume of chromium-bearing liquors by 40% (dry tanning); (c) recycling of non-contract process water; and (d) switching to non-chrome tanning processes.

enforcing separate payment for sewage discharges. The two major tannery cooperatives—TELIPA and ACUBA—already or will soon operate communal treatment facilities to recover chrome and help their members to reduce both their water use and the pollution loads that they discharge. As a side benefit, the tanneries will tend to reduce their use of groundwater—either by cutting down on their water use or because it is less attractive to find an alternative to water supplied by Aguas Argentinas—which will slow the intrusion of pollutants into the second groundwater aquifer that is being exacerbated by improper management of the first aquifer.

Policy Instruments for Pollution Control Management

3.30 *Effluent Fees.* In Buenos Aires specifically, the privatization of the water utility has radically changed the incentives for better environmental performance. Businesses have now to deal with a company which—at least in

principle—has a strong interest in reducing the costs that it bears as a result of industrial discharges of wastewater. Hence, Aguas Argentinas has been taking seriously its obligation to monitor the quality of such discharges and to report violations of the sewer discharge regulations. The company also has an incentive to charge prices for water consumption and wastewater discharges by businesses which cover the marginal costs of supply and treatment, since the revenue earned in this way will lessen the pressure to raise prices paid by households.

3.31 A move to differentiated sewage discharge fees, to reflect the pollution loads discharged and corresponding treatment costs, would strengthen the incentive for enterprises to operate their existing treatment facilities more effectively as well as to install new treatment plants or to work together to develop communal treatment arrangements. However, this incentive must be extended to those enterprises which currently discharge to storm drains, rivers, and other destinations to discourage substitution between discharge destinations. The danger is that the shift to economic prices in one sphere may prompt business to switch to other alternatives which remain un- or under-priced -- ie. to rely more heavily upon groundwater or to discharge wastewater to stormwater drains or rivers and streams. This means that the environmental authorities should institute as soon as possible a system for monitoring the volume of discharges other than to sewers and the associated pollutant concentrations, so that fees reflecting the pollution loads in such discharges can be assessed and levied. The level of fees should be such that it is cheaper for enterprises with discharge rates in excess of 5 m^3/hr to treat their wastewater and remove most of the pollution load. The introduction of these discharge fees should be phased over a period sufficient to allow enterprises time to assess and implement the most cost-effective way of reducing their emissions.

3.32 A previous attempt was made in 1980 to introduce discharge fees for industrial effluent (Decree 2125/1980; *Cuotas de Resarcimiento por Contaminación*). The structure was that of a two part tariff with a fee for discharges between the permitted discharge and a maximum allowable discharge, and much higher penalties for discharges above the maximum allowable threshold. There were provisions for increasing the level of fees gradually over 10 years and for the granting of transitory waivers for up to two years where enterprises were in course of implementing abatement measures. In practice, the fees were never applied on a wide basis and the system was modified in 1989 to lower the level of fees and to revise the penalties imposed on enterprises exceeding the maximum allowable discharge. Environmental groups sued the Government on the grounds that the *Cuota de Resarcimiento* amounted to a license to pollute beyond legal limits. The court declared the decree unconstitutional on formal legal grounds and the issue remains somewhat confused in legal terms. It appears that the court regarded the fee as exceeding the powers of the National Government to levy taxes and that it could not be justified as payment for a service.

3.33 Clearly, this legal uncertainty needs to be resolved before an appropriate system of incentives can be put in place. One way of addressing the issue may be to use a new framework environmental law—discussed in Chapter 4—as the basis for establishing the general principle that the state has the right to charge those who use any of the country's natural and environmental resources. Thus, for example, charging those who discharge water or air pollutants should be no different from charging stumpage fees to those who cut timber in national forests, depletion fees for the mining of metals or the production of oil and gas, or license fees for those who exploit coastal fisheries. The Government may choose to waive such fees in particular cases, but the general principle must be unambiguously established. If this is not done, the scope for using economic incentives to improve environmental quality will always be subject to dispute and uncertainty. The outcome will neither benefit those who care about the environment nor those who seek economic

Box 11: Small and Medium Enterprises (II): The Meat Products and Metal Finishing Industries

Meat Products

In Gran Buenos Aires there are about 150 plants producing meat products such as salami, sausage, ham and hamburgers. Four are quite large (employing more than 250 people), but the remainder are small and medium enterprises. The industry generates a range of water pollutants including BOD, suspended solids, ammonia and organic nitrogen. Only 5 firms have a biological treatment system to remove organic pollutants from their wastewater. Others have simple treatment system to remove organic pollutants and coarse solids, but many of these systems are ill-maintained or overloaded. Untreated or partially treatment effluent is discharged to sewers or to nearby streams. The chamber of industry claims that lack of space means it would be impossible or very difficult for most firms to install better treatment facilities.

A project to build a communal wastewater plant was initiated but was subsequently abandoned on the grounds that it would be too expensive to transport wastewater to a central facility by pipe or by truck. It is claimed that the industry could not afford a mobile wastewater treatment unit - capable of treating up to 10 m^3 per day and costing about $50,000. In practice, the enforcement of the provincial wastewater discharge regulations is so weak - inspections are irregular or do not occur at all, and only two firms have been penalized for non-compliance in the recent past - that enterprises have no incentive to incur any costs to mitigate their emissions.

Metal Finishing

There are about 800 firms engaged in metal finishing located in Gran Buenos Aires with a further 100 firms each in Córdoba and Rosario. Most of firms are small, employing less than 50 people, and the largest firm employs less than 200 people. The main pollutants are emitted in liquid effluents and include non-ferrous metals - copper, zinc, tin, chromium, and nickel - and various chemicals used in metal surface treatment.

Most firms rely upon groundwater and discharge their wastewater to sewers or stormwater drains with little or no prior treatment. Nominally, 70% of the firms dealing with non-precious metals have wastewater treatment plants, but it is estimated that up to 80% of these plants do not operate properly. Typically, they are overloaded, while the relevant regulations are both complex and are rarely enforced so that there is an incentive to by-pass them altogether. Some plants use chemical treatment to reduce Cr_6 to Cr_3 and to precipitate heavy metals. About one-half of the zinc platers and all of those using precious metals sell their metal-bearing effluents to recyclers. There are about 15 recycling plants in Gran Buenos Aires, but only two of them operate on a significant scale.

The volume of wastewater discharges could be substantially reduced (by 80-90%) through a number of pollution prevention measures: (a) reduction of water use; (b) segregation of wastewaters; (c) countercurrent rinsing; (d) greater emphasis on water recycling; and (e) process modifications such as partial evaporation before reuse. These measures would also reduce pollutant loads and thus the cost of any end-of-pipe treatment.

development. Experience throughout the world is that attempts to enforce strict environmental standards by administrative mechanisms or legal regulations alone invariably fail, while imposing unnecessarily high costs for the improvements that are achieved.

3.34 Some of the administrative burden of environmental management can be shifted to the polluter through a prudent selection of policy instruments. In cases where enforcement problems or uncertainties about damages are significant, such as hazardous waste or liquid effluent disposal, presumptive charges or performance bonds are an attractive policy option. With these instruments, charges are assessed on the basis of the worst reasonable emissions. A polluter who shows that actual emissions are less (for example because proper treatment can be documented) can claim a refund. This procedure shifts the burden of proof from the administration to the polluter.

3.35 Financial incentives. for reducing industrial pollution could be justified for several reasons:

- a properly designed subsidy for investments in pollution control can reduce monitoring costs for environmental compliance;
- following justice considerations, the Government may wish to respect an

established company's "historically acquired" right to pollute;

- the social costs of effective enforcement of environmental regulations may be considered to be too high;
- distortions in other markets may constrain effective enforcement. For example, in the absence of a well functioning credit market, enforcement can push solvent firms into liquidity problems or even out of business.

3.36 A particular concern in Argentina is the existence of a large small and medium enterprises (SMEs) sector that is in a weak competitive situation as a result of disadvantages in access to capital, technology and markets. The effectiveness of strict enforcement of environmental regulations and effluent charges is likely to be constrained by the resistance of this sector, based on fears about the number of firms that might be driven out of business if environmental regulations were seriously enforced. To alleviate such concerns, the provision of a share of the resources needed for achieving compliance is an important component of environmental policy in many countries, through incentives such as:

- technical assistance grants for environmental impact assessments (EIAs), environmental audits, and the preparation of pollution control/prevention investments;
- innovative programs to improve access to credit for pollution control/prevention investments;
- guarantees for private sector investments (e.g., guarantees of enforcement of environmental regulations to and by the operators of common treatment facilities and hazardous waste treatment plants).

3.37 Since the Government is committed to phasing out all subsidies to the private sector, its access to multilateral financing could provide an opportunity for providing financial incentives at no direct cost to the budget. One possible approach that would be cost-effective for achieving environmental objectives but needs to be evaluated in the context of the overall strategy to improve the efficiency of Argentine capital markets would would be to auction off the financing from multilateral banks to local commercial banks and use the proceeds to fund technical assistance for EIAs, and other appropriate expenses on a grant basis. The participating banks would onlend the funds for pollution control/prevention investments whose eligibility would have been determined by the EIAs or other appropriate criteria. Such a program would be a particularly effective instrument for addressing pollution problems in highly polluting industries (e.g., tanneries, foodprocessing, electroplating) which consist of SMEs that have no access to credit or only access to credit with maturities of one-two years. Strict enforcement of environmental regulations would imply a bias against such SMEs, mainly due to the inefficient and uncompetitive nature of capital markets. An environmental credit facility for solvent SMEs appears to be an attractive financing option to offset this bias.

Hazardous Waste Management

3.38 A recent study of hazardous waste in the Province of Buenos Aires lists the petroleum, chemical, petrochemical, metal, leather and textile industries as the major sources of hazardous wastes.[56] The same study also contains a list of industries which claim that they would have difficulties in paying the treatment costs for the hazardous waste they produce because of their economic situation. These include the leather tanning and textiles industries among the major hazardous waste producers plus the timber, paper, mechanical assembly, ceramics, glass and batteries. Such claims may be questioned in the light of the data given in 18, since the cost of dealing with all solid wastes

56. Dames & Moore, Estudio de Factibilidad - Residuos Peligrosos - Provincia de Buenos Aires, Dirección Provincial de Medio Ambiente, Ministerio de Salud y Acción Social, Buenos Aires, 1993.

(non-hazardous as well as hazardous) is barely more than 1% of value-added in the worst of these industries. Since the costs of treating and disposing hazardous wastes are less than 20% of total solid waste costs in both the leather and paper industries, these costs should be tiny in relation to the overall turnover of the industries.

3.39 The key—in these sectors especially—is to minimize the amount of waste generated in the first place. The cost of hazardous waste treatment and disposal are quite high in comparison with CEAMSE's tipping fee for non-hazardous municipal waste of $10/ton. As reported in the recent study, the costs of such services in the US range from US$500-750 per barrel (of 200 liters) for the disposal of highly toxic waste, to US$50-75/ton for the treatment of soils contaminated with hydrocarbons and US$0.05-0.08/liter of liquid effluents. The main effect of such a treatment cost schedule should be to lead enterprises to examine their operations to find ways by which they can recover, recycle or otherwise reduce hazardous wastes. After such operational changes have been implemented, they will find that they have a much lower volume to deal with and, as a result, will have less difficulty in meeting the necessary disposal costs. Provided that the charges levied by those responsible for treating and disposing wastes are designed to cover the full costs involved, there will be ample incentive for businesses to find ways of reducing the volumes of wastes that they generate. Of course, for the market signals to be effective, the monitoring and enforcement of hazardous waste regulations will need to be strengthened to the extent of making it unviable for enterprises to dispose of their untreated wastes in illegal open air dumps, improperly designed leaching pits or local streams.

3.40 So far no officially licensed treatment plant for hazardous wastes exists in Argentina. To address the hazardous waste problem, the government has studied the feasibility of attracting private investors to establish a treatment and disposal facility (involving an investment of about $50 million) in Gran Buenos Aires. This project has not progressed, however, mainly due to the difficulty of finding a suitable site. Several efforts to date have encountered strong opposition from the local population and municipal authorities. The issue is a standard problem in dealing with the location of a locally undesirable facility and the procedures followed to date have repeated most of the classic mistakes. At the root of the problem is a question of trust: SERNAH and other technical specialists insist that such a facility—if it is properly operated—should create no danger or nuisance for those living in nearby communities; the residents do not believe that it will be properly operated, and they do not see they should bear the costs of facility which will benefit industries or people elsewhere in the metropolitan area.

3.41 To deal with the first of these concerns, before the process of final site selection begins SERNAH must announce what the ground rules will be. Thus, (i) what will be the environmental standards that must be met by any hazardous waste treatment facility? (ii) how will compliance with these standards be monitored and enforced (for example, will there be some kind of performance bond required)? (iii) will there be any kind of public review process which would allow those concerned about the actual performance of the facility to raise their concerns? A greater degree of transparency and public consultation is essential, since otherwise the process will remain bogged down by legal and procedural arguments that are fuelled by lack of information and suspicion.

3.42 The second concern raises the central issue of compensation. Even if a hazardous waste facility poses no environmental threat, many people will continue to think that it does. Thus, those living near to the selected site will suffer a perceived loss of amenity and, quite probably, capital losses on any property that they own. The answer is simple: compensate those living close to the plant, either on an individual basis or via the provision of additional community facilities. One form of compensation is to offer to purchase all properties within a

'sanitary zone' around the plant and pay a disturbance allowance to any tenants who have to move.[57] This may be used in conjunction with some form of community-oriented compensation involving one time capital expenditures on infrastructure or communal services[58].

3.43 Once the ground rules for operating the plant have been laid down and technical investigations have been undertaken to rule out any potential sites that may be unsuitable on technical grounds, the final decision on the selection of a site may be made by means of a 'compensation auction'. Communities would be asked to state what level and form of compensation would be required for them to accept the facility, which would then be located at the site with the lowest costs including compensation. There have been criticisms of such a decision mechanism on the grounds that it will result in such facilities being located in the poorest communities. This may be true but the argument is disingenuous, since that tends to be the outcome of location decisions made on 'technical' or political grounds. At a minimum, the compensation auction gives communities an opportunity to express their views in a meaningful way and ensures that they are compensated adequately.

3.44 The payment of compensation also has the merit of internalizing (as a capital sum) the externalities with the existence or operation of a hazardous waste treatment plant. Thus, the cost of treating hazardous wastes will be correspondingly higher than under some other arrangement, which provides a stronger incentive to reduce the generation of hazardous wastes. As has been emphasized, the crucial concern is to minimize the volume of hazardous wastes wherever this is cost effective, so that the correct market signals are essential to stimulate industries to modify processes and operational practices. This assumes, of course, that such incentives are relevant in the sense that enterprises do not have the option of dumping or otherwise disposing of their wastes at little or not cost because of the lack of an effective system of regulations with appropriate monitoring and enforcement arrangements.

3.45 Recently, a national Hazardous Waste Law (Law 24.051 of January 8, 1992) has become effective. SERNAH has issued regulations pertaining to this law (Decree 831/93 of 23 April 1993 and Resolution 242/93 of 24 June 1993). However, many provinces reject national control of hazardous waste regulation, and this law is currently effective only in the Capital Federal, some of the surrounding municipalities, and interprovincial waters. Under the new law all companies need to register their hazardous emissions with SERNAH. The law includes a tax, depending on quantity and type of effluent up to 1 percent of profits from the generating activity, and gives SERNAH policing power. There has been widespread criticism of the Hazardous Waste Law and concern that it creates an onerous bureaucratic burden, particularly on small-scale producers of hazardous waste. As long as there are no hazardous wastes treatment facility in place, actual enforcement of the law is unrealistic since there are no short term alternatives to continuing discharges or ceasing operation.

Institutional Arrangements

3.46 The role of the Government in shaping the pace and nature of environmental improvements in the industrial sector will be crucial. Unresolved interjurisdictional conflicts resulting from the current patchwork of legislation, regulations, and judicial intervention combined with totally ineffective mechanisms for enforcement, imposes a substantial

57. It is crucial that the 'sanitary zone' should be large enough to allow for foreseeable expansion in the plant and that all occupants should be moved out of the zone, so that the question of making repeated compensation payments does not raise if the plant is subsequently expanded.

58. Again, for the incentive to be correct the compensation must take the form of a lump capital sum or even if this is effectively paid in installments over a number of years rather than an ongoing commitment to sustain some level of services or payments for an indefinite period.

environmental cost by delaying changes that would occur in a more neutral institutional framework. Industrial enterprises will not commit significant resources to fund measures to improve their environmental performance without a reasonable assurance that the 'rules of the game' will not change before they have recovered their costs. In fact, from the private industry side the absence of a clear regulatory framework has been mentioned as the major constraint to the implementation of pollution abatement measures.[59]

3.47 The effect of the present confusion from national-provincial relations, overlapping responsibilities and constrained budgetary resources, could be mitigated if there were a clear political consensus in favor of tackling environmental issues. In the absence of such a consensus, there are ways of reducing the degree of confusion. The emphasis should be placed on a sectoral approach to tackling issues of industrial pollution. The legislative framework is weak, but there is scope for negotiating and enforcing agreements between all levels of government, industrial enterprises and other interested parties which would build upon the links between better economic and environmental performance outlined above. These agreements could cover the time schedule for achieving compliance with the agreed standards as well as the standards themselves. It would also be possible to introduce certain regulatory or market-based instruments—such as mass-based emission standards or pollution charges or liquid effluents—which would have a significant impact on the incentives facing industrial enterprises.

3.48 Evidence of voluntary compliance with environmental standards in many countries suggests that improved environmental management does not depend upon formal regulation and enforcement alone. The release of information on emissions and pollution control practices to the public often stimulates pollution abatement by enterprises with a poor record. Other 'soft approaches' include efforts to promote cleaner technologies, and modest financial or other support for the preparation of environmental audits and the implementation of their recommendations on a demonstration basis.

Chambers of industry and trade associations have an important role to play in publicizing best practice technologies and operational procedures to senior and middle managements and in bringing environmental authorities, NGOs and others together with industry executives to hammer out voluntary agreements.

Environmental Policy and International Competitiveness

3.49 As argued earlier in this chapter, there are strong grounds for believing that the opening up of the Argentine economy[60] will bring environmental benefits by (a) accelerating the adoption of newer, cleaner technologies, (b) the influence of foreign investors who expect their local operations to achieve higher levels of environmental and operating efficiency, and (c) the preferences of customers in some foreign markets that suppliers should, where possible, conform to the "green" certification requirements such as those of ISO 14,000. However, these considerations carry little weight with medium and small enterprises which are struggling to adapt to a transformed business environment. Import-competing industries have lost much of their protection. Export-oriented industries have

59. ADEGA, "Gestión Ambiental en la Industria - Resultados del Relevamiento - Conclusiones y Recomendaciones", report by ADEGA (Asociación para el Desarrollo de la Gestión Ambiental), CEADS (Consejo Empresario Argentino para el Desarrollo Sostenible), UIA (Unión Industrial Argentina), and INEM (International Network for Environmental Management), Buenos Aires, 1994.

60. Argentina's most important trading partners are Brazil (21.3% of exports, 21.3% of imports), the United States (9.7% of exports, 23.0% of imports), the Netherlands (9.7% of exports, 1.3% of imports), Germany (4.8% of exports, 6.1% of imports), and Chile (4.5% of exports, 4.2% of imports). Exports to main trading blocks are MERCOSUR (28%), EU (27.9%), and NAFTA (11.9%). Total exports amounted to US$13.1 billion in 1993 and are divided into manufactured agricultural products (38%, mostly feed and food residues, oils, meat, and skins and leather), industrial goods (28%, mostly electric appliances, vehicles, metals, and chemicals), primary products (25%, mostly cereals, oilseeds, and fish), and fuels (9%).

Table 18: Pollution Control Costs for U.S. Industries Producing Traded Goods

Standard Industrial Classification (US SIC)		Pollution control costs as percentage of value-added			Pollution investment as percentage of total investment
		Air	Water	Solid Waste	
201	Meat products	0.1	0.8	0.2	4.3
2011	Meat packaging	0.1	0.7	0.2	7.4
203	Preserved fruit & veg	0.0	0.5	0.3	4.2
204	Grain mill prods	0.3	0.3	0.3	2.5
207	Fats & oils	0.4	0.7	0.2	4.0
2075	Soybean oil mills	1.0	0.5	0.3	4.3
2077	Animal & marine fats and oils	0.2	0.4	0.1	9.8
221	Cotton fabric mills	0.3	0.7	0.3	1.2
222	Manmade fabric mills	0.0	0.2	0.2	0.9
225	Knitting mills	0.1	0.3	0.1	2.0
226	Textile finishing, except wool	0.1	0.9	0.2	1.7
228	Yarn & thread mills	0.0	0.2	0.1	0.2
261	Pulp mills	1.0	2.2	0.7	22.3
262	Paper mills	1.1	2.2	1.0	7.8
263	Paperboard mills	1.0	1.8	0.8	12.1
281	Industrial inorganic chemicals	1.0	1.6	1.2	12.4
282	Plastics materials & synthetics	0.6	1.1	0.9	8.2
283	Pharmaceuticals	0.1	0.3	0.2	4.3
285	Paints & allied prods	0.2	0.3	0.8	5.0
286	Industrial organic chemicals	1.1	2.5	1.4	12.0
289	Misc. chemical products	0.3	0.8	0.7	5.5
291	Petroleum refining	5.5	2.6	1.4	13.1
311	Leather tanning & finishing	0.3	2.4	1.2	6.5
331	Blast furnace & basic steel prods	1.7	1.5	0.8	6.8
332	Iron & steel foundries	1.5	0.5	1.0	10.6
333	Primary nonferrous metals	4.2	0.5	0.7	14.0
334	Secondary nonferrous metals	4.4	1.0	1.6	25.0
335	Nonferrous rolling and drawing	0.4	0.9	0.9	4.0
336	Nonferrous foundries	0.4	0.5	0.9	7.0
3471	Metal plating & polishing	0.7	5.2	2.7	26.0

faced an appreciating real exchange rate. All have to cope with more competition from larger multinational enterprises, high real interest rates, and a Government with a new view of the relationship between the state and business. In these circumstances they are inclined to resist any suggestion that they should be required to meet stricter environmental standards, even where these may be a catalyst for the adoption of more efficient operating practices and technologies. This resistance is articulated by expressions of concern that any obligation to improve environmental performance will increase production costs, and thus, threaten Argentina's international competitiveness.

3.50 While some kinds of environmental regulation may, indeed, impose a significant burden on certain industries, there is no evidence to believe that this would be a major consideration in Argentina at present. The available data consistently shows that the environmental control costs are a very small component of total production costs and value-added. Table 18 draws upon the results of a 1989 survey of pollution control costs by industry in the US. Columns 1 to 3 show the share of pollution control costs (including materials, labor, depreciation of equipment, and fees for disposal) separately for air, water and solid wastes as percentages of value-added for a selection of industries for which total trade (imports + exports) exceeds 10% of the gross value of

domestic production. Column 4 gives the percentage share of pollution control investments in total investment expenditures. Two rows—for petroleum refining (291), and metal plating and polishing (3471) - cover industries which do not produce traded goods. They are included because they are important sources of industrial pollution in AMBA and they have the highest control costs relative to value-added.

3.51 The table shows that the costs of water pollution control (including sewage fees) represent less than 3% of value added for all of the traded sectors with most being less than 1%. Even considering total pollution control costs, the share is less than 5% of value-added for all except industrial organic chemicals, primary and secondary nonferrous metals. Thus, to the extent that U.S. and Argentine industries can be regarded comparable (in terms of technologies and cost structure) the empirical evidence suggests that stricter environmental standards might not pose a significant threat to the competitiveness of Argentine industries. There are, of course, industries for which the additional costs do represent a more significant share of value-added but the main examples are petroleum refining and metal plating which are both protected from international competition by transport costs and other factors.

3.52 Indeed, the figures in the table substantially overstate the likely cost to Argentine businesses of achieving a higher level of environmental performance. The country is near the bottom of the cost curve in terms of the marginal cost per unit improvement in environmental performance. There is ample scope for modifying processes and operations in ways that bring both economic and environmental benefits. Therefore, in many cases economic and environmental gains should come together, so that the marginal costs are negative. Beyond that, any move to implement higher environmental standards should and will be phased over a period of time, so that businesses will have the opportunity to find the least cost methods of meeting these standards.

3.53 Further, the Government has a choice about the way in which environmental improvement is achieved. One of the characteristics of US environmental policy is its heavy reliance upon relatively inefficient regulatory mechanisms that have imposed unnecessarily high costs on industry in order to achieve its environmental goals. Argentina can choose, instead, to adopt a more flexible approach combining elements of regulation and market incentives as appropriate, thus minimizing any impact on competitiveness.[61] It appears that regulatory uncertainty and bureaucratic harassment in the wake of environmental regulation would generate higher costs and be a more serious impediment to investments than tighter pollution control requirements per se. Thus, concerns about the potential impact of environmental improvement on international competitiveness are not a good reasons to postpone such improvements. They should be seen, instead, reinforcing the need for care in setting priorities and for the adoption flexible and cost effective mechanisms to meet the country's environmental goals.

Recommendations

3.54 *Government-Industry Cooperation.* The main objective of the recommended sectoral environmental action plans would be to define clear "rules of the game" that will allow industry to undertake investments in pollution control and treatment with reasonable assurance that it will recover the costs before the rules are changed. These agreements should cover:

(a) the relevant standards for air, wastewater and solid waste emissions that will apply to the industry.

61. Pearce, David and Brisson, Inger, "BATNEEC: the economics of technology - based environmental standards, with a UK case illustration", Oxford Review of Economic Policy 9:24-40, Winter 1993. A survey of empirical studies (Pearce and Brisson, 1993) shows that the social costs of pollution control through CAC regulation exceeds the least cost option by a factor between 1.1 and 22.

(b) a timetable for bringing industry into compliance with the standards, with identification of priority investments and other actions.

(c) arrangements for monitoring of the environmental performance of the industry, based on voluntary self-reporting, backed up by auditing or spot checks by the government.

(d) any incentives which the government may wish to provide, such as the provision of technical assistance grants and credit for pollution control projects that are consistent with the priorities established in the action plan.

3.55 *Financial Incentives for Small and Medium Enterprises.* Since the GOA is committed to phasing out all subsidies to the private sector, its access to multilateral financing could provide a means for providing credits and technical assistance to the SMEs at no direct cost to the budget. To maximize the effectiveness of this instrument, and minimize market distortions, the following conditions are recommended:

(a) the government could (i) arrange financing from a multilateral development bank, (ii) auction off the funds to all eligible banks, and (iii) use the difference between the cost of funds and the auction yield to fund technical assistance for the preparation of eligible projects, environmental audits and EIAs on a grant basis.

(b) the participating banks would onlend the funds for eligible projects at commercial rates.

(c) to guard against financing insolvent SMEs, the intermediary banks need to be given full autonomy in their creditworthiness evaluation, and accept the full credit risk for the loans they make.

(d) to ensure the eligibility of the project, financing would be limited to investments that fall within the scope of an agreed government-industry action plan for pollution reduction (see previous para).

3.56 *Reintroduction of Effluent Fees.* In regard to the strengthening of the regulatory and incentive framework, it is recommended that the government consider the use of economic instruments, such as user fees, to provide appropriate incentives for environmentally responsible decisionmaking. Specifically:

(a) the reintroduction of effluent fees for liquid, gaseous and solid wastes. As a general principle, the charges should reflect the costs of waste removal, treatment and disposal, or the marginal social cost of environmental damages, whichever is higher. The use of such economic instruments provides appropriate incentives for reducing the generation of pollution, and for the development of enterprises specialized in the removal, treatment and disposal of all types of waste materials.

(b) the effluent fees should be paid by the polluters regardless of where the waste is discharged (e.g., into sewers, streams, landfills, the atmosphere), and should be transferred to the enterprises providing the removal, treatment and disposal services and to environmental agencies to cover the cost of monitoring and enforcement. The earmarking of effluent fees for environmental services should minimize resistance from polluters and avoid the legal issue of being regarded as taxes.

(c) the introduction of effluent fees should be phased in over a period sufficient to allow enterprises time to assess and implement the most cost-effective way of

reducing their emissions, through improved environmental management (e.g., good housekeeping, recycling, proper use of existing treatment facilities), and appropriate investments (e.g., for cleaner process technologies, waste treatment facilities).

(d) to minimize the risk of legal challenges, the introduction of effluent fees should be supported by appropriate legal instruments (e.g., the proposed framework environmental law) to establish the general principle that the state has the right to charge those who use any of the country's natural and environmental resources.

3.57 *Hazardous Wastes.* To address concerns associated with the proposed hazardous waste treatment and disposal facility, as well as establish appropriate procedures for other environmentally controversial projects, the Government may wish to clarify the ground rules and consider establishing compensation arrangements for the affected population for any environmental risks. More broadly, it is recommended that:

(a) site selection for projects with a major environmental impact (e.g., a hazardous waste plant), should be based on clear ground rules in regard to (i) the applicable environmental standards that must be met, (ii) arrangements for monitoring and enforcement of these standards, (iii) arrangements for a public review process to back up compliance and enforcement of applicable standards.

(b) compensation and resettlement of populations affected by environmental impacts of projects needs to be discussed and agreed with the community in a transparent manner. For example, site selection for a hazardous waste plant may be made by means of a "compensation auction", in which communities would be asked to state the compensation level required to accept the facility. The facility would then be located in the lowest cost site, taking community compensation into account.

(c) the economic viability of the facility needs to be protected through a strengthening of the monitoring and enforcement of hazardous waste regulations so as to discourage polluting enterprises from disposing of their hazardous wastes in unlicensed open air dumps, improperly designed leaching pits and other illegal but low cost alternatives.

3.58 *Least Cost Strategy for Water Pollution Control.* In view of the magnitude of proposed investments for water pollution control (in AMBA alone, $900 million for sewage treatment and disposal, and $800 million for industrial effluents), the Government may wish to consider the need for more detailed studies to establish the least cost strategy for reducing water pollution, taking into account the tradeoffs between sewage treatment and control of industrial effluents. The recommended studies include:

(a) a detailed inventory of industrial pollution sources in each major industrial area of the country, by type of industry and pollutant, location, and availability of waste treatment facilities.

(b) using data on pollution removal rates and costs for standard waste treatment technologies, the inventory of industrial pollution sources described in (a), and estimates of the cost and pollution removal performance of different levels of sewage treatment, develop a least cost program for achieving alternative levels of environmental cleanup for each of the water bodies of interest (e.g., the Río de la Plata, the Río Reconquista, the Río Matanza-Riachuelo). In particular, evaluate the trade-offs in pollution

reduction between sewage treatment and industrial pollution control.

(c) compare the costs of environmental cleanup for specific water bodies, as described in (b), with estimates of the benefits of cleanup (i.e., the costs of pollution related damages—as discussed in Chapter 1), to determine the relative value and priority of cleanup efforts by location and by level of environmental attainment.

(d) on the basis of the above, evaluate the appropriate phasing and sequencing of investments for the cleanup of the Río Reconquista, Río Matanza-Riachuelo and sewage treatment projects in the AMBA, taking economic and financial resource constraints into account.

4. Managing Transport Sector Pollution

Current Situation and Problems

4.1 Motor vehicles are the main source of air pollution in downtown areas and major traffic corridors elsewhere. Pollutants such as lead, carbon monoxide, and particulate matter primarily affect the local environment, while other pollutants such as nitrogen oxides and carbon dioxide also contribute to regional and global environmental problems (acid rain and greenhouse effect). Air quality data are not readily available; however, based on preliminary findings, the social costs of transport sector pollution are not believed to be as serious as those associated with other transport related externalities such as accidents, congestion, the degradation of urban space and noise. However, while the consideration of non-pollution externalities of transport is important for evaluating policy options, a complete evaluation of transport policies, taking in particular congestion effects into account, is beyond the scope of this report.

4.2 At present, nearly 4 million motor vehicles, both passenger and cargo vehicles, are in circulation in the Area Metropolitana de Buenos Aires (AMBA), out of which one third is registered in the Capital Federal. The metropolitan fleet of passenger transport vehicles is composed of about 2,500,000 private cars, 40,000 taxis, 15,000 buses, plus 1,450 suburban and 500 subway (metro) train wagons. While buses and trains are the preferred means of transport of suburban commuters, a breakdown of traffic volumes by zone indicates that (i) taxis represent well above 50% of all vehicles circulating in the micro center, followed by cars (25%) and buses (below 15%); (ii) cars account for about 45% of macro center traffic, followed by taxis (40%) and buses (6%.); and that (iii) with increasing distance from the central area the role of taxis diminishes.

4.3 *Cars.* Private car ownership in Argentina has increased significantly since 1991, with some 100,000 cars being added each year in the Buenos Aires area alone, mainly due to increased availability of consumer credit. Old age, coupled with inadequate maintenance and engines that use unclean fuels make these vehicles an important target of pollution abatement. At present, there are no mandatory inspections for private cars and, thus, no effective enforcement of emission standards.

4.4 *Taxis.* With about 38,600 registered taxis and about 7,000 illegally operated cars, Buenos Aires has one of the highest taxi per capita ratios of major cities around the world. The total number of taxis has increased dramatically in recent years, partly due to the deteriorating quality of the subway system, and partly because of worsening congestion and parking problems. Taxis have to undergo an annual technical inspection for their annual license renewal. In the past, "*remises*" (chauffeured short-term rentals) have captured an increasing share of the taxi market. Currently, 155 "*remiserias*" (agencies, with about five cars each) are operating legally, and another 743 agencies operate illegally.

4.5 *Buses.* In the metropolitan area, about 15,000 buses are in scheduled operation by 240 companies. Despite their potential for being an environmentally more benign mode of transport than private cars, buses appear to be a major source of transport related air pollution in Buenos Aires. Out of the total bus fleet, about 300 run on CNG, with the remainder running on diesel fuel. Emissions from diesel buses tend to be very high as vehicles are old and often undermaintained. Revenues are declining due to the emergence of charter buses and remises and could induce bus enterprises to cut back further on maintenance.

4.6 In recent years, charter bus operations have become a popular alternative to conventional public transport services for

Table 19: Selected Air Pollution Measurements

Location/Pollutant	SPM (Tg/m^3)	SO_2 (Tg/m^3)	NO_x (Tg/m^3)	CO (ppm)	Pb (Tg/m^3)
Capital Federal (selected measurements in July 1993 and May 1994)	70-90	3-18	38-240	day: 7-14 even: 5-9 night:<1	0.3-3.9 (see Table 3)
Mendoza (selected measurements in July 1993)	30-250	0.2-5.4	0.6-5.3		
Córdoba (annual averages based on regular measurements 1988-1991)	80-192	32	41-50		
Palpala, Jujuy (average of 82 24 hr measurements in 1990)	209	46.3			22.9
US EPA Primary Standards	75 (Annual Geometric Mean)	80 (Annual Arithmetic Mean)	100 (Annual Arithmetic Mean)	9 (8-hour Average)	1.5 (Quarterly Average)

commuters from suburban areas located 20 to 30 km outside of the central Buenos area. Compared to regular bus operation, travel on charter buses is faster and more convenient due to reliable schedules and guaranteed seats. Until recently, numerous previous rail commuters deemed charter buses superior to suburban rail services due to the declining quality and safety of rail transport. This trend may be reversed if the privatized suburban rail lines improve the quality of rail transport. Informal bus lines operate illegally and compete for passengers with authorized bus lines. These "operaciones clandestinas" often generate higher emissions as their fleet mainly consists of retired long distance buses from the 1970s.

4.7 *Rail.* The railway sector has gone through major changes over the last years. Until very recently, the state-owned railway enterprise Ferrocarriles Argentinos (FA) was the sole provider of passenger and cargo services, including six suburban railway lines and the subway in Buenos Aires. After consistently producing high operating deficits (reaching US$1 billion in 1987) and allowing significant deterioration of assets, the privatization of FA was initiated in 1989 by leasing long-term concessions for cargo services and one passenger service between Buenos Aires and Mar del Plata. Passenger service within GBA, including the Buenos Aires subway, was reorganized under a separate regional authority, the Railway Restructuring Coordination Unit.

4.8 As part of its nation-wide Railway Restructuring Program, the Government in 1991 called for bids to award operating concessions for

Table 20: Emissions from motorized vehicles in the city of Buenos Aires in 1993 (tons)

Fuel	SO_2	SPM	CO	NO_x	HC	Total
Gasoline	355	1,314	247,689	6,767	9,527	265,652
Diesel	11,738	1,483	27,183	6,796	1,545	48,745
Total	12,093	2,797	274,872	13,563	11,072	314,397

Bank staff estimates based on emission coefficients for the city of Buenos Aires from: Mazzola et al., República Argentina, Informe Nacional Programa de Contaminación Atmosférica and fuel sales data from: ADEFA, Industria Automotriz Argentina 1993.

Table 21: Fuel Consumption in 1993

	Capital Federal	AMBA	Argentina
Regular	166.2	952.0	2,273.2
Super	721.6	2,494.6	4,177.5
Diesel	735.5	4,221.7	8,689.1
CNG	274.9	582.7	764.5

Source: Prensa Vehicular, No. 70 (15 October, 1994), in thousand m^3, CNG in million m^3.

the subway and the six suburban railway lines. In 1994, a 20-year concession became effective for the subway, combined with a suburban railway, and 10-year concessions for three suburban railway subsystems. The initial results of private operation are most encouraging, as the numbers of tickets sold have increased by 30-70% for the suburban railways, and by 20% for the subway, compared to last year's ticket sales. It is expected that the contracts for the remaining two railway concessions will be signed soon. With the entire mass transit system being operated by private firms, service quality is likely to increase and, thus, attract an increasing share of commuters.

Transport-Related Pollution

4.9 As discussed in Chapter 1, the increasing numbers of vehicles in circulation and serious congestion problems in the center of Buenos Aires are producing considerable levels of transport related pollution. It is estimated that, in 1993, over 300,000 tons of pollutants were emitted from motorized vehicles in the Capital Federal alone (see Table 19).

4.10 While the emission of pollutants can be quantified, it is difficult to estimated what it means in terms of ambient air quality, as there is very little systematic information about air pollution levels and compositions. Some available measurements were shown Table 20. These suggest that, at least some of the time, lead, NO_x and CO levels exceed the recommended targets in some areas of downtown Buenos Aires, and particulate concentrations exceed the recommended targets in Mendoza and Córdoba. Overall, while the information is too sparse to determine the dimensions of the severity of the problems, the potential long-term low-dose consequences are serious enough to merit further study and systematic monitoring.

4.11 The pattern that emerges is that the seriousness of air pollution varies depending on topography and the local winds. In Buenos Aires, despite of a high level of urban concentration and vehicle use, the potential impact of air pollution has been mitigated by a favorable wind regime. Nonetheless, the winds are not sufficient to disperse the pollution collecting in narrow,

heavily travelled streets during working hours when traffic fumes accumulate to unhealthy levels. Thus, air pollution is primarily an inner city problem for drivers, pedestrians, workers, shoppers and residents who are subject to vehicle pollution. The situation is reported to be similar in most cities in the Pampas, such as Rosario and San Nicolás. For cities in more mountainous areas, such as Mendoza, Córdoba and Salta, topography and wind conditions can occasionally lead to atmospheric inversions that trap pollutants and allow their accumulation to reach dangerous levels throughout the entire urban area.

4.12 Given the size of the exposed population in Buenos Aires, and the fact that the health consequences of low-level lead pollution tend to be more severe than those associated low-level NO_x and CO pollution, it would appear that lead pollution is the most serious of the transport-related air pollution issues that needs to be addressed. This points to the high priority of reducing the lead content in gasoline and switching to other, less polluting fuels. In regard to the control of particulates, NO_x, CO and other transport-related pollution, different policy options address the problem at different stages. Policies aiming at improved engine maintenance and efficiency attempt to reduce emissions per distance of a given mode of transport (i.e. train, bus, or car). Other policies aim at influencing the modal choice toward less polluting transportation systems (i.e. trains or non-motorized transport). Finally, urban spatial management can be used to reduce the demand for polluting transport services in the long run.

Fuel Choice

4.13 *Compressed Natural Gas (CNG).* In 1985, a program of tax exemptions was introduced to promote the replacement of petroleum fuels by compressed natural gas (CNG). The program was quickly adopted by mid-sized trucks and taxis. By the end of 1994, 210,000 vehicles in AMBA had been converted to CNG-usage. Of the nearly 40,000 official taxis about 65% use CNG, with the remainder running on diesel; out of the 15,000 registered buses, only about 300 run on CNG. To date, the CNG program has led to the substitution of about 12% of diesel use in the AMBA, which should correspond to a 6% reduction in particulates emissions. Total fuel consumption figures are shown in Table 21.

4.14 CNG-fueled cars are preferred by many taxi owners as the fuel costs (@\$0.26/m^3) are slightly below diesel prices (@\$0.27/liter), and new CNG taxis tend to be 30-35% less expensive than new diesel taxis. However, the potential for switching buses to CNG seems very limited, mostly due to the inconvenience associated with refueling.[62] Refueling times for CNG are long. Gas stations, including compressors, require and investment of about \$1.5 million. In addition, new CNG buses tend to be more expensive than diesel-fueled buses: the price of a new diesel bus is about \$85,000 versus \$90,000 for a new CNG bus. In addition, CNG vehicles are somewhat less fuel efficient that diesel and gasoline-powered vehicles, due to the extra weight of the gas cylinders.

4.15 While CNG-fuelled vehicles produce less NO_x, CO, hydrocarbons, particulates and lead matter than gasoline-fueled vehicles, and less particulates than diesel-fuelled vehicles (see Table 22), there is concern about possibly higher levels of NOx emissions compared to conventional fuels under real life operating conditions. On balance, however, based on the scant information discussed in Chapter 1, there appears to be a greater health cost attributable to lead and particulate pollution (mainly due to the greater mortality risk), than NOx, CO or hydrocarbons. Thus, until further evidence becomes available, it is appropriate to regard CNG as an environmentally "cleaner" fuel that

62. While the costs to gas stations are \$0.13/m3 for CNG and \$0.20/l for diesel, the corresponding retail prices are \$0.26 for CNG and \$0.27 for diesel (and \$0.81 for gasoline). During the day, refueling a bus with CNG takes about 15 min. with a fast-fueling pump, 20 minutes or more with a normal pump, whereas during the evening hours when pressure is higher tanks are filled with two pipes within 8 min.

Table 22: Emissions of CNG-fueled Versus Diesel Buses

Bus Type	NOx	HC	CO	Particulate m.
CNG city bus	4.3	2.1	0.4	< 0.05
CNG regional bus	2.9	3.1	2.5	< 0.05
diesel bus	14.0	1.2	4.0	0.55
EU standards for 1996	7.0	1.1	4.0	0.15

Source: Prensa Vehicular, No. 70, 15 October 1994.

gasoline or diesel fuel, and to signal this virtue through appropriate pollution-based fuel tax differentials in relation to both gasoline and diesel fuel.

4.16 *Unleaded gasoline.* Unleaded gasoline was introduced in Argentina only about 1 1/2 years ago, and, to date, less than 5% of all cars run on unleaded gas. At a lead content of 0.2 g/liter, about 900 tons of lead are added to gasoline per year. The use of unleaded gas is expected to increase in the future as old cars, which require leaded gasoline, are being replaced by cars with catalytic converters, which require unleaded gasoline. A bill currently in parliament would, require the rapid transition toward the use of catalytic converters and lead free gasoline. For the time being, owning a car that requires unleaded fuel can be problematic due to the limited availability of unleaded gas outside of AMBA.

4.17 Illustrative calculations in Chapter I have shown that the reduction of atmospheric lead pollution in AMBA by 1 Tg/m^3, such as would be obtained by the replacement of leaded by unleaded gasoline, would reduce annual health damages by about $53.6 - 123.1 million. If this estimate is accepted, the benefit of unleaded fuel use in AMBA can be estimated at about $ 0.02-0.04/liter of gasoline, compared to additional gasoline production costs of $0.01-0.02/liter.[63]

One effective way of provide incentives for the production and use of unleaded gasoline would be to reflect the lower pollution damage of unleaded gasoline in the form of a differential (of say, $0.04/liter) in the fuel tax.[64]

Emission Standards and Vehicle Maintenance

4.18 Vehicle technology and the quality of vehicle maintenance greatly influence vehicle emissions. Improving maintenance practices, particularly for diesel-fueled vehicles, is crucial to improving air quality. The car park is old, in particular outside of Buenos Aires, and not equipped with the most recent environmentally benign technologies. Due to economic crisis, many owners could not afford adequate vehicle maintenance such as replacing clogged air filters.

4.19 *Emission standards.* Decree 875/94 of National Law 2254/92 establishes national emission and noise standards for new and used motor vehicles (see Table 23). The Decree also assigns the *Secretaría de Recursos Naturales y Ambiente Humano* (SERNAH) as the responsible agency for enforcing and updating these standards. These emission limits were reinforced by the Joint Resolution 96/94 and 58/94 by the Secretaries of Transport and Industry of March 1994. Emission limits are established with a different compliance schedule for trucks and urban passenger transport vehicles. In addition, emission limits for particulate matter are established for the years 1996 and 2000. The new

63. Based on international market price differentials. The cost differential could be higher in Argentina during an initial period when economies of scale for the supply of unleaded fuel have not yet been attained.

64. At present, there is a fuel tax of about $0.35/liter on unleaded and super gasoline, and of $0.25 on regular gasoline.

Table 23: National Emission Standards in Decree 875/94

Emission Limits for New Light-duty Gasoline or Diesel Vehicles

model year	CO (g/km)	HC (g/km)	Nox (g/km)	CO* in low gear (%)	HC* in low gear (ppm)
1994	24.0	2.1	2.0	3.0	660.0
1995	12.0	1.2	1.4	2.5	400.0
1997	2.0	0.3	0.6	0.5	250.0
1999	2.0	0.3	0.6	0.5	250.0

Emission Limits for New Heavy-duty Gasoline or Diesel Vehicles

model year	CO (g/kwh)	HC (g/kwh)	NOx (g/kwh)	CO* in low gear (%)	HC* in low gear (ppm)
1995	11.2	2.4	14.4	3.0	660
1997	11.2	2.4	14.4	2.5	400

Emission Limits for Used Gasoline Vehicles

model year	CO* in low gear (%)	HC* in low gear (ppm)
1983-1991	4.5	900
1992	3.0	600
1994	2.5	400

Emission Limits for Used Diesel Vehicles

model year	Bacharach ind.	Abs. coff. (m -1)
1994	5	2.62

* for gasoline vehicles

Source: Boletin Oficial, No. 27.919, 1a Seccion, 27 July 1994.

exhaust emission standards for new light-duty gasoline-fueled vehicles, new heavy-duty vehicles, diesel-fueled vehicles, and for all used vehicles still clearly exceed US emission limits. A new regulation also requires the retirement of buses older than 10 years (about 3,500 buses) in 1995. Crucial to effective pollution control will be, however, that the new standards be enforced. Municipal emission standards in the Capital Federal are embodied in Ordinance No. 39,025 and appear to be tighter than national emission limits.

4.20 There are still several areas where environmentally benign engine technology can be advanced in Argentina. For example, new cars are not necessarily equipped with catalytic converters.[65] However, new emission standards will encourage the adoption of vehicle emission control technologies. Domestic engine technology needs to be improved not only to reduce domestic air emissions but also to keep up automobile exports to Brazil after the introduction of the common market. With the implementation of MERCOSUR, emission standards need to be harmonized by 1997 to maintain exports of automobiles to Brazil.

4.21 *Vehicle inspection programs.* At present, about 400,000 buses and trucks operating in the Gran Buenos Aires area and about 250,000 taxis and other commercial vehicles registered in the

65. Equipping cars with oxidation catalysts could reduce CO and HC emissions by as much as 90%; three-way catalysts could reduce HC and CO emissions by as much as 95%.

Capital Federal are subject to periodic inspections:

(a) Buses, both CNG and diesel-fueled, have to be inspected in 6 months intervals at one of the 12 inspection stations owned and operated by the private firm CENT under the supervision of CONTA (*Comisión Nacional del Transporte Automotor*), and under the jurisdiction of the *Secretaría Nacional de Transporte*. The emphasis of these inspections is on safety aspects, and emissions are only controlled visually. The inspection stations lack the equipment needed to analyze emission samples. A new regulation will require all inspection stations to have a certain basic equipment for carrying out pollution control.

(b) Taxis and commercial vehicles are inspected by SACTA, a (private sector) concessionaire under the jurisdiction of the Capital Federal.[66] The main objectives of the technical controls are to ensure compliance with safety standards and, to a smaller extent, with environmental norms for gas and noise emissions. Exhaust emission controls are limited to carbon monoxide and hydrocarbons for CNG, and (leaded) gasoline-fueled vehicles; diesel-fueled cars are only tested for opacity.

4.22 Non-compliance appears to be a severe problem of vehicle inspection programs. While non-compliance with the mandatory annual check-ups in taxis is relatively low at less than 5% (out of 38,500), it is significantly more common among trucks and passenger transport vehicles: only 10% of 170,000 registered trucks and about 8% of the 21,000 registered passenger transport vehicles show up for annual inspections.

4.23 To reduce non-compliance, the municipal *Secretaría de Planeamiento Urbano y Medio Ambiente* together with the municipal police carry out sporadic road checks. Their results suggest that 25% of all vehicles operated in the Capital Federal violate emission norms. In April 1994, 235 out of 898 randomly stopped vehicles, or almost 25%, failed to meet emission limits. During this month, the controls found that 15% of the checked buses (80 out of 483 buses), nearly 40% of the tested trucks (96 out of 252 trucks), and more than one third of the inspected cars (59 out of 163 cars) violated the standards.[67] In addition, CONTA introduced a "hot line" for reporting buses emitting excessive smoke. SACTA also carries out random road side controls.

4.24 Both the Province and the Capital Federal are contemplating the introduction of mandatory inspections for private vehicles. The Province of Buenos Aires appears to be one step ahead of the Municipality, as tenders have already been solicited from private inspection firm. Enforcing environmental standards for roughly 2,750,000 private and commercial vehicles in the Provincia, and for about 2,500,000 private vehicles in the City of Buenos Aires would have an important environmental impact.

4.25 In contrast to Buenos Aires, recent experiences in Mendoza and Córdoba suggest that air pollution can be reduced significantly through improved vehicle maintenance. These cities are reported to have achieved significant improvements in air quality by enforcing the compliance with emission standards.

Congestion Management and Modal Choice

4.26 The pollution intensity of alternative passenger transport modes varies significantly, largely as a function of fuel use per person-

66. Inspection charges are $42 per taxi and $21.50 for re-inspection upon rejection.

67. In 1991, 66% of the surveyed cars in circulation was found to be non-compliant with the CO emission limit of 4.5%. In 1992, lowering the limit to 2.5% resulted in 90% of the gasoline-fueled fleet to be non-compliant.

Box 12: The Singapore Area Licensing Scheme

The Singapore Area Licensing Scheme (ALS) was introduced in 1975, with the sole motivation of reducing congestion in the central business district. The scheme was a package of measures that included:

- the requirement of a license fee for private cars (S$3/day) and taxis (S$6/day), to enter the central business district during rush hours: Monday-Saturday from 7:30-10:15 am and 4:30-6:30 pm. A valid license ticket must be displayed on the windscreen.
- the construction of a new 67 km mass rapid transit system with 42 stations (completed in 1990).
- bus improvement (the fleet was increased from 2,300 to 3,200 buses, and now uses 70 km of bus lanes).
- a park and ride scheme, with 13 peripheral car parks and over 10,000 spaces, with shuttle services to the central business district.
- a new bypass avoiding the city centre.

The scheme had a dramatic effect on reducing congestion, and continues to be very effective. The number of cars entering the restricted zone during rush hours declined from about 44,000 daily before ALS to about 13,000 daily afterwards, and had remained at that level since. Even before the completion of the mass rapid transit system, the modal split of passenger traffic (public transport/private car/other) had shifted, from (46/43/11) in 1974 to (63/22/15) in 1988.

Source: The Singapore Area Licensing Scheme, Room Document No. 4, Informal Workshop on the "Use of Economic Instruments in Environmental Policies", OECD, Paris, 1993.

kilometer. Non-motorized transport (e.g., bicycles) causes no pollution; followed by trains, buses, and cars in ascending order, with cars being about ten times as emission intensive as buses, on a per passenger-km basis. Nevertheless, experience in other countries suggests rapid increases in car ownership rates with rising income levels. In 1992, there were 6.9 inhabitants per car in Argentina, compared to 1.8 in the United States. This trend focusses attention on strategies for avoiding or even reversing the expected increase in private car usage.

4.27 A variety of options exists to induce commuters to switch from private cars to less congesting and less polluting public transport modes. Gas taxes represent a simple mechanism that does, however, not discriminate between different car users in lightly or more heavily congested and/or polluted areas. High parking fees or access controls for congested/polluted areas are more targeted. A good example of the successful implementation of a package of access controls and congestion fees is the Singapore Area Licensing Scheme (see Box 12).

4.28 *Congestion Management Policies.* Early in 1994, the National Congress announced a state of emergency for transit in the Capital Federal and ordered that solutions to the serious congestions problem be sought. A subsequently implemented restriction on vehicle usage (cars

with a license plate ending with a particular number were not allowed to use their car in the downtown area on a particular day of the week) appeared to have a minor alleviating effect on congestion.

4.29 At about the same time, the *Subsecretaría de Transporte y Tránsito* of the Capital Federal submitted a proposal for a congestion alleviation program. The plan calls for a major reorganization of innercity traffic based on a clearly formulated modal hierarchy according to which subway transport should be given top priority, followed by collectivos, taxis and private cars. The key element of the proposed urban transit policy is the segregation of transport modes to improve traffic flows. As a first step, it was envisaged to introduce bus lanes on a pilot basis, to be followed by a more radical phase II which would extend the pilot bus lane scheme to the all main arteries. At the same time, it was envisaged to limit the traffic in the narrow streets, to taxis and buses to discourage the use of private cars in the congested downtown area. To date, only two short pilot bus lanes have been implemented.

4.30 *Influencing Modal Choice.* Measures that would increase the attractiveness of public transport are crucial, including changing the relative speed of different modes, for example through the use of well-enforced bus lanes. Strengthening bus transport could alleviate the serious congestion problems in the city's downtown area. Introducing bus lanes as part of a more comprehensive traffic restructuring program would reduce travel time for buses and, thus, render bus transportation more attractive.

4.31 Urban and sub-urban railway lines have a great potential for absorbing a substantial part of work related commuting trips. In recent years, the railways experienced a significant decline in ridership, mainly due to unreliable schedules and safety concerns. However, shortly after the privatization of several railway lines, rail transport seems to be attracting new passengers. Rehabilitating parts of the subway and suburban railway network is very likely to get more commuters off the roads, in particular if bus and rail tariffs were to be integrated. An additional train line (Coastal Train) will be reopened in March 1995.

4.32 At present, bicycle use in the downtown area is virtually non-existent. Bicycles appear to be used only in outlying areas to gain access to train stations. Unlike in Asian cities, policies for reducing congestion by promoting non-motorized transport have been extremely limited in the case of Buenos Aires, partly because urban development has been largely unsupportive of non-motorized transport. Policies to encourage non-motorized transport would include bicycle lanes, and further access restrictions for motorized vehicles in downtown area.

Urban Spatial Management

4.33 Urban land use management and demand for transport services are closely interlinked. Demand for urban transport is generated by the spatial separation of different urban functions such as housing, working, and shopping. Housing density determines the feasibility of different transport systems. Due to the complementarity between infrastructure and individual investments (i.e., roads and cars; public transport and houses), exclusive reliance on markets will not bring about efficient urban land use, and there is a case for regulatory intervention. Urban spatial management can move the development of a city toward lower transportation demands or transportation needs that can be met by a transport system with less congestion and pollution. Urban spatial management will lead to improvements only in the medium and long-term. However, the current economic recovery with increasing investment activities marks a suitable time for directing attention at the long term linkages between city development and environmental quality.

4.34 High and medium density housing that is spatially integrated with other urban functions (workplace, services, shopping) reduces the

demand for transport and thereby reduces transport related externalities. Settlement patterns also determine the viability of different transport systems. A certain housing density is required for viability of efficient public transport. High density development along major transportation corridors and provision of secondary service to these corridors (bicycle and car parking at metro stations, feeder bus services) can further increase public transport viability.

4.35 There are interesting examples for urban transport and spatial management that have resulted in remarkable success and can serve as models for Argentine cities. The widely quoted example of integrated management of urban land use and transport is the city of Curitiba, Brazil. Successful policy measures to reduce the costs of transport related externalities in this city include: a) improved public transport; b) provisions for pedestrians and cyclists; c) traffic calming; d) land use policies that concentrate on increasing density in existing urban space rather than encouraging outward sprawl; and d) integration of land use and transport policies by mixing homes, jobs, and services.[68]

Recommendations

4.36 *Fuel Choice:* To encourage the use of environmentally less damaging fuels, it is recommended that the government consider adjusting the existing structure of fuel taxes to reflect the pollution damage externalities associated with the use of a given fuel. While the accurate determination of the social damage costs associated with each type of fuel will require much more data collection and analysis, it would be useful to introduce the polluter pays principle through a couple of initial measures that can already be justified, at least for the major urban areas, based on the available information:

(a) a fuel tax adjustment to create a $0.04/liter differential between leaded and unleaded gasoline to reflect the social damage cost of lead emissions. This would be consistent with the practice in OECD member countries, most of which have tax differentials between US$0.03 and US$0.09. The objective is to make unleaded than leaded gasoline.

(b) a fuel tax adjustment to increase the cost of diesel in relation to that of CNG, to reflect the social damage cost of particulate emissions. The differential should be great enough to provide an incentive for the greater use of CNG in city buses.

4.37 *Emission Standards and Vehicle Maintenance:* Air pollution originating from vehicles is unnecessarily high. Even though a detailed assessment of air pollution levels in Buenos Aires is a precondition for any serious air pollution control management strategy, many low-cost measures are available to significantly reduce current pollution levels. The recommended measures include:

(a) the updating of new vehicle emission standards to put them in line with international practices, both to protect the local environment and enhance the export competitiveness of locally manufactured cars. First priority needs to be given to the harmonization of standards within Mercosur.

(b) the introduction of mandatory inspections for private cars (as in Mendoza and Córdoba), and the strengthening of inspections for commercial vehicles, in all major urban areas, to encourage compliance with applicable emission standards.

(c) the retrofitting of vapor recovery devices at fuel storage tanks, delivery trucks and service stations in all major urban areas. Based on experience in other countries,

68. Lowe, Marcia D., Shaping Cities. The Environmental and Human Dimension. Worldwatch Institute, 1991.

the retrofit costs are small and, based on the benefit of fuel savings alone, the payback periods should be about 2-3 years.

(d) the establishment of an air quality monitoring program to determine the existing levels of air pollution in urban areas, the population at risk and the degree of health hazard.

4.38 *Congestion Management and Modal Choice:* Given the expected rapid increase in private car ownership, the growing threat of unmanageable congestion and pollution problems in the major urban centers makes it essential that the supply and attractiveness of public transport be increased through appropriate measures. While the development of a master plan for urban transport development is urgent but beyond the scope of this report, several measures can already be recommended based on the assessment of current problems and experiences elsewhere:

(a) the implementation of traffic engineering measures to eliminate bottlenecks, improve signalization, and improve operating speeds of public transport, with general objective of reducing congestion and vehicle idling.

(b) the implementation of well-enforced bus lanes in all major traffic arteries in the metropolitan area.

(c) in tandem with (a), the expansion of access controls for private cars in the congested central business district, to limit traffic in the narrow streets to taxis and buses.

(d) the rehabilitation and expansion of the existing subways and suburban rail lines.

(e) the improvement of passenger access to public transport (better crossings and safety improvements), and the rerouting of suburban buses into improved intermodal exchanges rather than downtown destinations.

(f) the encouragement of pedestrians and cyclists through further restrictions on motorized vehicles in narrow downtown streets, construction of bicycle lanes between residential areas and railway stations, and the provision of adequate storage facilities at train stations and bus terminals.

(g) for the long term, a master plan for public transport development, with coordinated networks of rail-based mass transit for the highest density inner city and city-suburban lines, and buses for lower density intra-city and suburban routes.

4.39 *Urban Spatial Management:* In Argentina, urban spatial management activities have come to a halt in the seventies due to the economic problems the country was facing at the time. Now that the economic problems are being successfully address, there is an opportunity to prepare again to think again in terms of the integration of urban land use and infrastructure development. Here again, while a lot of study will be required to develop an optimal approach for the long term, a few recommendations are already worth pursuing in regard to mitigating environmental concerns associated with transport demand:

(a) the fragmentation of the metropolitan transport sector between the Capital Federal, the Province of Buenos Aires, and the 19 municipalities in the AMBA, appears to be the most important constraint to the implementation of a comprehensive and coherent urban transport policy. The creation a coordination mechanism for metropolitan transport and air pollution control would constitute a necessary first step towards addressing transport related pollution issues on an areawide basis.

(b) for the long term, land use planning should concentrate high density settlements along major transportation corridors in manner that is integrated with other urban functions (workplace, services, shopping). Such a pattern would allow for the more efficient provision of urban services, including local and long distance transport, and reduced environmental externalities, in comparison with the existing pattern of sprawling suburbs and irregular settlements.

5. Managing Solid Wastes

5.1 The collection and disposal of solid wastes is an important component of the environmental infrastructure. Lacking collection or proper disposal of solid wastes can provide a habitat for disease vectors, pollute ground surface water resources and reduce the amenity and property value of surrounding areas. In the absence of collection, garbage piles up in empty lots and local streams, where they constitute a health risk and a source of contamination. Overall, while the problems are well understood in Argentina, they are not being systematically monitored or studied.

5.2 Some open air dumps (*basurales)* raise concerns due to their poor location, design and operation, including the lack of controls regarding their use for the disposal of hazardous wastes. Specific problems relate to their inadequate buffering from inhabited areas (mostly irregular settlements), their accessibility to scavengers and children, their location in low areas subject to flooding, and their contamination of groundwater. This is of concern since *basurales* are often located near irregular settlements, whose population tends to rely on handpumps to draw water from shallow groundwater aquifers. In the case of a *basural* in Florencio Varela, it is known that pollution reaches the second groundwater layer, which is most important as a drinking water source. Also, rainwater and floods often transport wastes from open air dumps into local streams contributing to their pollution. The practice of burning solid waste in open air dumps contributes to air pollution.

Current Situation

5.3 In most parts of the country, solid waste is collected by municipal contractors, deposited and, sometimes, burned in open-air dumps. This practice is becoming less and less acceptable when the quantities of disposed solid waste, the population density, and thus the risk of serious pollution damages, increase. In the Area Metropolitana de Buenos Aires, a policy toward sanitary landfills has been initiated in 1978. In some of the other major cities (Rosario, Córdoba, Mendoza) the current situation of open-air dumping of solid wastes is becoming unsustainable and plans for the building of sanitary landfills are at different stages of preparation or execution.

5.4 *Solid Waste Management in the Area Metropolitana de Buenos Aires.* In the past, solid waste used to be burnt in open air dumps. In 1978, Coordinación Ecológica Area Metropolitana Sociedad del Estado (CEAMSE) was created in 1978 by the Municipality and the Province of Buenos Aires to build and operate sanitary landfills based on modern standards. The Capital Federal, the 19 municipalities of AMBA and three municipalities of Gran La Plata are legally required to deliver their solid wastes to CEAMSE.

5.5 In the Capital Federal, the municipality itself collects wastes in a small part of the city and delivers it to CEAMSE's transfer stations. In another part of the Capital Federal, a private company, CLIBA, is contracted by the municipality for collection and transport to the transfer stations. The major part of the Capital is serviced by another private sector contractor, MANLIBA, which, is contracted directly by CEAMSE, which in turn bills the municipality for the collection services. The other municipalities contract private companies or undertake themselves the collection and delivery of wastes directly to CEAMSE's landfills. The majority of contracts are based on the area covered, while three municipalities have awarded contracts based on collected tonnage, which improves collection quality but requires supervision against collection of excessive waste.

5.6 CEAMSE charges the municipalities a tipping fee of US$10 per ton of household waste

delivered to the landfills.[78] In the case of the Capital Federal, CEAMSE charges the municipality an additional $17 per ton for processing and transport from the transfer station to the landfills. In MANLIBA's collection area, average collection costs are about $42 per ton. Data from other municipalities were not available, however, it is estimated that collection costs are somewhat higher and service quality inferior in those areas where municipalities themselves operate the collection service. Local cost recovery from the waste producer is based on municipal policy. Usually, a lump-sum fee/tax for street cleaning, solid waste disposal and other services is charged to every household. Households do not pay for waste disposal by quantity and have, therefore, no incentives for reducing waste.

5.7 CEAMSE's tipping fee covers the operation costs of sanitary landfills but not their land purchase and rehabilitation costs. Moreover, due to the precarious situation of municipal finances, not all municipalities pay their fees. In fact, the tipping fee is regularly paid by only 5 out of 23 municipalities. To cover its variable costs, CEAMSE retains provincial revenue sharing grants from 13 additional municipalities. One consequence of this revenue shortfall has been its inability to follow up on its mandate to acquire new lands to convert into green areas and future landfill sites.

5.8 The volume of solid waste received by CEAMSE's landfills has increased over the last years from 2.3 million tons in 1990 to 4 million tons in 1993. This increase is due to increased economic activity in combination with a reduction of illegal garbage dumping. Per capita waste generation differs widely by municipality. Garbage receipts range from 0.321 kg per capita per day in Florencio Varela to 1.386 kg per capita per day in the Capital Federal. These differences reflect differences in economic activities and different shares of total garbage generation delivered to CEAMSE. To accommodate increasing solid waste volumes, CEAMSE is planning the expansion of transfer stations, construction of an additional transfer station, and expansions of the landfill system. It is also planning to expand services to additional municipalities.

5.9 Open air dumps continue to exist in AMBA despite the municipalities' obligation to deliver all solid waste to CEAMSE's sanitary landfills. In addition to CEAMSE's landfills, there are two other common channels for the disposal of solid wastes from AMBA: *basurales* which are defined as open air dumps of two hectare or more and usually systematically operated, and other open air dumps which are smaller and not systematically operated. Both types of dumps are illegal. A particular concern is that, since CEAMSE's sanitary landfills control the quality of the wastes they accept for deposit and reject the more hazardous and toxic wastes, it is likely that those are dumped illegally under uncontrolled conditions.

5.10 Reportedly, full truckloads of solid waste are still being dumped illegally against payment of cash to the operator of the *basural* (about $10 per truckload of up to 8 tons) or, in the case of unorganized dumps, to residents and bystanders. In the past, many municipalities used to operate their own garbage dumps. Still, several municipalities perceive local damages as low, tolerate open air dumping within their jurisdiction, and realize savings in transport and disposal costs.

5.11 By its own estimate, CEAMSE only receives about 4 million tons/year of solid waste of the 5.6 million tons/year produced in the areas. The remainder is still disposed of in illegal dumps. It is estimated that there were over 200 open air dumps in AMBA during the mid 1980s. This was reduced to about 100 open air dumps by 1988. In 1992 there were still 74 basurales in AMBA. According to rough estimates, CEAMSE received only about 50% of total garbage produced in 1990. This increased to about 71% in 1993 based on the above estimates by CEAMSE.

78. This compares to tipping fees of between US$40 and $120 per ton in industrial countries.

5.12 The situation is complicated by the fact that illegal waste dumps are a significant income source for the poorest segments of the urban population. Therefore, closure of these dumps would lead to strong political resistance. In several cases, the operation of *basurales* is closely integrated with the informal economy of irregular settlements (*villas miserias*). In these cases, a solution to the pollution problem emanating from illegal garbage dumps needs to incorporate consideration of living conditions and employment opportunities in these settlements.

Policy Issues

Solid Waste Collection and Disposal

5.13 Local concerns focus on inadequate or non-existent collection in irregular settlements which concentrate the poorer population of the cities and in semi-rural areas. Often, municipalities refuse to collect solid wastes in areas where no property taxes for garbage collection or other municipal services are collected. Policies should focus on the improvement of solid waste collection and disposal in the poorer areas and cities where those services do not meet modern environmental standards. Possible solutions include participation by neighborhood association or other non-governmental organization in the provision of services.

5.14 In the long-run, the practice of open-air solid waste dumping needs to be discontinued in all urban and semi-urban areas. The development of sanitary landfills should have priority, where they do not yet exist, particularly in larger cities or where current uncontrolled disposal causes environmental damages. Sufficient willingness to pay by municipalities should be ensured before the implementation of landfill projects.

5.15 CEAMSE, in cooperation with the municipalities of AMBA needs to develop a program to close the remaining *basurales* in AMBA or bring them up to modern sanitary standards. Such a program will succeed only if it is based on municipalities recognition that garbage dumps within their jurisdiction create unacceptable health and pollution risks. The program should also include policies for the rehabilitation and employment generation for the *villas miserias* that currently receive income from the operation of the *basurales*.

5.16 A common problem is that if tipping fees were increased to cover the full capital costs of the landfill investment and land rehabilitation, the incentive for illegal dumping would be increased further. This problem could be avoided if some of the costs of landfilling, as well as solid waste collection and transportation, would be directly collected from the producers of solid waste, such as households. Volume-based solid waste fees for households have already been pioneered in other countries, providing a solid financial foundation for the collection, transport and disposal of solid waste as well as appropriate incentives for waste volume reduction and recycling (See Box 13).

Recycling

5.17 A large share of recyclable material in solid wastes is currently recycled through informal activities at different stages of the garbage collection and deposition process. There is no precise information on the extent of informal sector recycling. A recycling rate of 40% has been quoted for glass, for example. Informal sector recycling activities have been declining as a result of the economic recovery and the subsequently rising opportunity costs of labor. The economics of informal sector recycling depends on the low labor costs in the informal sector. Informal recycling activities are likely to decline if unskilled wages increase. Problems of the informal sector recycling system include unsanitary conditions and the costs of evasion of the law as the following incident illustrates: a local company that used to buy old glass bottles for reuse/recycling was forced to discontinue the practice after a tax investigation that revealed that the suppliers in the informal recycling sector did not pay taxes.

Box 13: Solid Waste Collection Fees in the Unites States

In the US, a few communities have instituted solid waste pricing systems that are based on the amount of waste, and provide an incentive for households to reduce waste generation:

- Seattle, Washington, introduced a rate structure based on a monthly charge of US$13.75 per 30-gallon garbage can. In 1989, monthly waste collections fell about 30% in comparison to 1988 levels, when the program started.
- In High Bridge, New Jersey, each 30-gallon can or bag placed at the curb for weekly pickup must have a sticker, which costs US$1.25. Since the introduction of this system in 1988, residential trash volume fell by 25%.

Most of the reduction can be attributed to the separation and recycling of glass, paper, and aluminum cans. As another result of these programs, however, some local businesses have had to chain and padlock their dumpsters. Also, some residents have illegally burned trash in their fireplaces.

Source: Inception Report, Informal Workshop on the "Use of Economic Instruments in Environmental Policies", Environment Policy Committee, OECD, Paris, 1993.

5.18 Land values and demand for environmental amenities are still too low to increase garbage disposal costs to a level that would render formal sector recycling of materials from municipal waste, such as paper, glass, and plastics, commercially viable. Recycling is also limited by the fact that the organic (non-recyclable) content of solid waste is still high with 55% in Buenos Aires and 75% in Mendoza. The financial problems can be appreciated when the current cost of collection and disposal (about $70/t in the Capital Federal) are compared to typical costs of curbside recycling programs of $262/t on average in Brazil, after accounting for the sale of recyclables ($30/t).[79]

5.19 There are several pilot recycling projects, many centered around schools and combined with educational initiatives, none of them are apparently financially viable. However, a complete economic analysis of these projects has not yet been carried out. Aluminum recycling appears to be an exception in terms of financial viability. Recently, a plant that accepts used aluminum cans has been opened and stimulated demand for aluminum recycling.

5.20 Due to the existence of externalities, the lack of financial viability does not necessarily imply that all recycling is uneconomic. Also if land prices and demand for a clean environment rise with higher incomes in the future, formal recycling will become more profitable as the disposal of waste product becomes more and more expensive. Therefore, it would be appropriate for the government to clarify the regulatory and incentive framework for recycling activities, so as to facilitate its appropriate development in tandem with economic trends.

Recommendations

5.21 *Improving Collection and Disposal.* Based on the above discussion, the most important priority is to promote the adequate collection and disposal of solid waste in sanitary landfills to replace the continued use of open air dumps in most parts of Argentina. This will require an integrated strategy involving increased

79. Wells, Christopher, "The Brazilian Recycling Commitment: Helping Stimulate Recycling in a Developing Country", in Industry and Environment, Vol 7, No 2, pp.14-17, 1994.

resource mobilization, and strengthened enforcement of environmental regulations:

(a) to mobilize the financial resources needed to improve collection and cover the costs of sanitary landfills, the recommended approach is to recover the costs from the customers through the use of volume-based solid waste fees. A minimum fee, covering basic needs, would have to be levied from each household to reduce the incentive for illegal disposal.

(b) to provide an incentive for local governments to adopt modern sanitary standards and increase cost recovery for their solid waste activities, the government should consider financial assistance for municipalities to build and equip sanitary landfills and commercialize their operation.

(c) to improve solid waste collection in low-income areas and illegal settlements at minimum cost, the municipalities should consider contracting such services to neighborhood associations or NGOs that may be able to provide collection services at lower costs through involvement with the informal sector.

(d) to reduce incentives for the illegal disposal of industrial and other wastes that cannot be accepted by the sanitary landfills, the government should promote investments in the development of specialized waste treatment and disposal facilities that would comply with appropriate environmental standards. Government assistance could consist of the development of clear guidelines for such facilities, assistance with site aquisition and approval, financial incentives, and strengthened enforcement of waste disposal regulations.

5.22 *Recycling:* As a complement to the development of improved solid waste collection and disposal services, the government should also consider the provision of an appropriate regulatory and incentive framework for recycling activities. A detailed study of the economics of recycling in is recommended to shed light on the question why informal sector recycling is still widespread while formal sector recycling is apparently still uneconomic. Interlinkages between both activities need to be explored (i.e. informal recycling reduces the share of recyclable material in collected waste and thus increases formal sector recycling costs). Possible policies to be studied for the improvement of social conditions in the informal recycling sector include the possibility to integrate the current informal sector into a regularized, cooperative system of waste material recovery.

6. Institutional Aspects Of Environmental Management

6.1 The development of an effective pollution control strategy requires a comprehensive assessment of the actual responsibilities and of the sustainability of the institutional arrangements. The objective is to outline a sustainable vision of the organization of the environmental policymaking for the country as a whole, rather than just the national level. This chapter discusses the question how Argentina is structuring its institutions to address the growing concerns for pollution management. It addresses the main weaknesses of the strategy and describes options to address these weaknesses.[80]

6.2 One important feature of Argentina's institutional framework is the federal system of government, in which the provinces delegate functions to the central government and maintain control over anything that is not delegated specifically. This implies that there are as many ways of organizing the control of pollution as there are provinces. Matters are in fact even more complex because the municipalities often have some autonomy on environmental issues, thereby allowing differences in legal requirements on environmental matters within a province.

6.3 A second unusual feature is that the institutional structures of the government are rapidly changing. Thus, a comprehensive national environmental agency was first established in 1965 as the *Dirección Nacional de Sanidad Ambiental* under *the Ministerio de Salud Pública.* In 1973, environmental matters were taken over by the *Secretaría de Recursos Naturales y Ambiente Humano* under the *Ministerio de Economía.* Its functions were dispersed in 1976, but reappeared in 1980 under the *Ministerio de Salud Pública y Medio Ambiente*, where it was later reorganized as the *Secretaría de Vivienda y Medio Ambiente* under the *Ministerio de Salud y Acción Social.* In 1987, national environmental policy was placed under the responsibility of the *Subsecretaría de Política Ambiental* reporting to the *Secretaría General de la Presidencia*, which became, in 1989, the *Comisión Nacional de Política Ambiental*, and since 1991, the *Secretaría de Recursos Naturales y Ambiente Humano (SERNAH)*, which reports directly to the Pre-sident. At present, there are plans to elevate SERNAH to the status of Ministry, which would give it greater status and autonomy.

6.4 The next section defines a benchmark based on the international experience against which the Argentine institutional structure can be assessed. Its main purpose is to highlight the issues that any environmental institutional structure has to have addressed to be successful. It is of direct relevance to the debate in Argentina since its structure is still in the process of being defined. The following section focusses on the current sector organization and problems in Argentina. The coverage provided here focuses on a few provinces and a few municipalities for illustrative purposes since a detailed assessment of each province would be out of scope for this report. The subsequent sections propose steps toward institutional reform, address the role of information and summarize the policy recommendations.

Lessons from the International Experience with Environmental Management

6.5 Every country faces a different political, socio-economic and institutional reality. Yet, there are common elements in all the successful approaches to environmental management. Although these elements are not sufficient to guarantee the success of environmental policy, they seem to be necessary conditions. This

80. Ongoing work at SERNAH under the IDB's T.A. for Environmental Management Institutions Projects will address some related questions. These effort are clearly worthwhile and will benefit from a vision ensuring that the structure at the national level is consistent with the needs and capacities across all government levels.

Box 14: The Dutch National Environmental Policy Plan

The strategic goal of the Netherlands' National Environmental Policy Plan (NEPP) released in 1989 is to solve the country's environmental problems within one generation. The central leitmotif is sustainable development. The operational guidelines rely on a few basic principles:

* do not degrade environmental quality any further
* base source oriented control on effect-oriented quality standards
* abate pollution at the source
* pick the best abatement techniques
* implement the polluter pays principle
* prevent unnecessary waste
* isolate,control and monitor waste
* force the internalization of environmental controls by polluters

The NEPP translates these principles into 50 strategic objectives and 228 specific measures targeted at seven specific groups: agriculture, transportation, industry, energy, construction, environmental management companies, and utilities. Consumers are also covered in the NEPP. The measures include the stabilization of CO_2 emissions at 1989/90 levels by 2000; specific targets for reduction of SO_2, NO, acid depositions, CFCs, pesticides and ammonia emissions; the introduction of environmental auditing; subsidies for energy conservation; increases in auto fuel taxes; increases in expenditures on mass transit systems.

section provides a brief overview of these minimum requirements for success of environmental management in decentralized economies, focusing on the aspects most relevant to Argentina's ongoing efforts.[81]

6.6 *The existence of a vision of the environment common to the population and to the government.* The most successful governments have based their management of environmental concerns on long term planning including an identification of the key environmental problems of the country and an analysis of the design of menus of options to solve these problems. This form of strategic thinking based on a vision of the sector tends to help nascent environmental authorities build an increasingly broad base of support. The implementation of this vision then consists of spelling out the marching orders for policy makers in a long range plan. For instance, in the Netherlands, the importance attached to the National Environmental Policy Plan reflects the high ranking of environment in the country's policy agenda. They have clear targets spelled out in documents adjusted occasionally to reflect the changes in preferences and in information (Box 14).

6.7 *The integration of environmental policy across media.* When environmental policy management is organized by medium (air, water, soil) or industrial sectors, it tends to result in *ad-hoc* solutions. The Environmental Impact Assessment (EIA) is an effective way of ensuring that all environmental aspects of a particular policy or project are considered at the same time. While, in the absence of clear guidelines, EIAs

81. This is section draws mostly on Weiss Jr, C. (1993), "Patterns of Environmental Management: National Structures for the Management of Pollution Control", draft, May 27, 1993. The World Bank, Mediterranean Environmental Technical Assistance Program but also on Estache and Taylor (1992): "Water Pollution Control: Which level of Government Should do What in Brazil, on Barrie, D. (1992), "Environmental Protection in Federal States: Interjurisdictional Cooperation in Canada and Australia", Australian National University, Federalism Research Center, Working Paper No.18 and Ringquist, E.J. (1993), Environmental Protection at the State Level: Politics and Progress in Controlling Pollution, New York: M.E. Sharpe.

can be costly and time consuming, they should provide a useful baseline of information that can reduce future monitoring and enforcement costs. In the South of Brazil, the information revealed in the EIA have often been used by NGOs and other local organizations to assist the authorities in providing an integrated monitoring of the various environmental effects of large investment projects.

6.8 *Matching of the degree and form of decentralization with the allocation of resources.* If decentralization of responsibilities is not matched with the decentralization of resources allocated to these specific expenditure categories, pollution control can be ineffective. This is because those responsible for the delivery of environment-related services end up without the resource-based incentives to deliver. In France, river basin agencies levy pollution and water use charges and use the money to finance capital improvements they are responsible for. In countries such as the UK where water utilities have been privatized, the private water companies are given revenue-raising powers for sewage treatment services.

6.9 *A participatory policy decision process and an effective court system.* Two main characteristics matter: how laws are being designed and how courts get involved. In many European countries, regulations are based on consultation of interested parties through working commissions. The outcome of the negotiation is then passed on to a politically neutral bureaucracy for implementation and enforcement. This is why in many countries environmental regulations are not issued until the main polluters are already in compliance with a proposed new regulation. In the US, NGOs and independent scientists are often key actors in the endorsement and adoption of a new environmental regulation. In Europe, the role of courts is focussed on enforcement and non-court mediation mechanisms are very effective. In the US judges can introduce new laws through common law. In either case, environmental education for the judges requires some investment.

6.10 *The existence of publicly accessible environmental information.* The most successful countries have managed to develop data bases (often through the EIA process) to base decisions on objective priorities rather than on subjective choices or on reactions to the best organized interest groups. The wider the access to that information the less likely environmental legislation is to be captured by narrow interest groups. This access to information has been a tradition in Sweden and the US for instance and is likely to become the norm in EU countries where the Commission recently adopted a directive providing for public access to environmental information. They are also part of decision making process in some provinces in Brazil, from the poorest (Ceará) to the richest (Paraná or Sao Paulo).

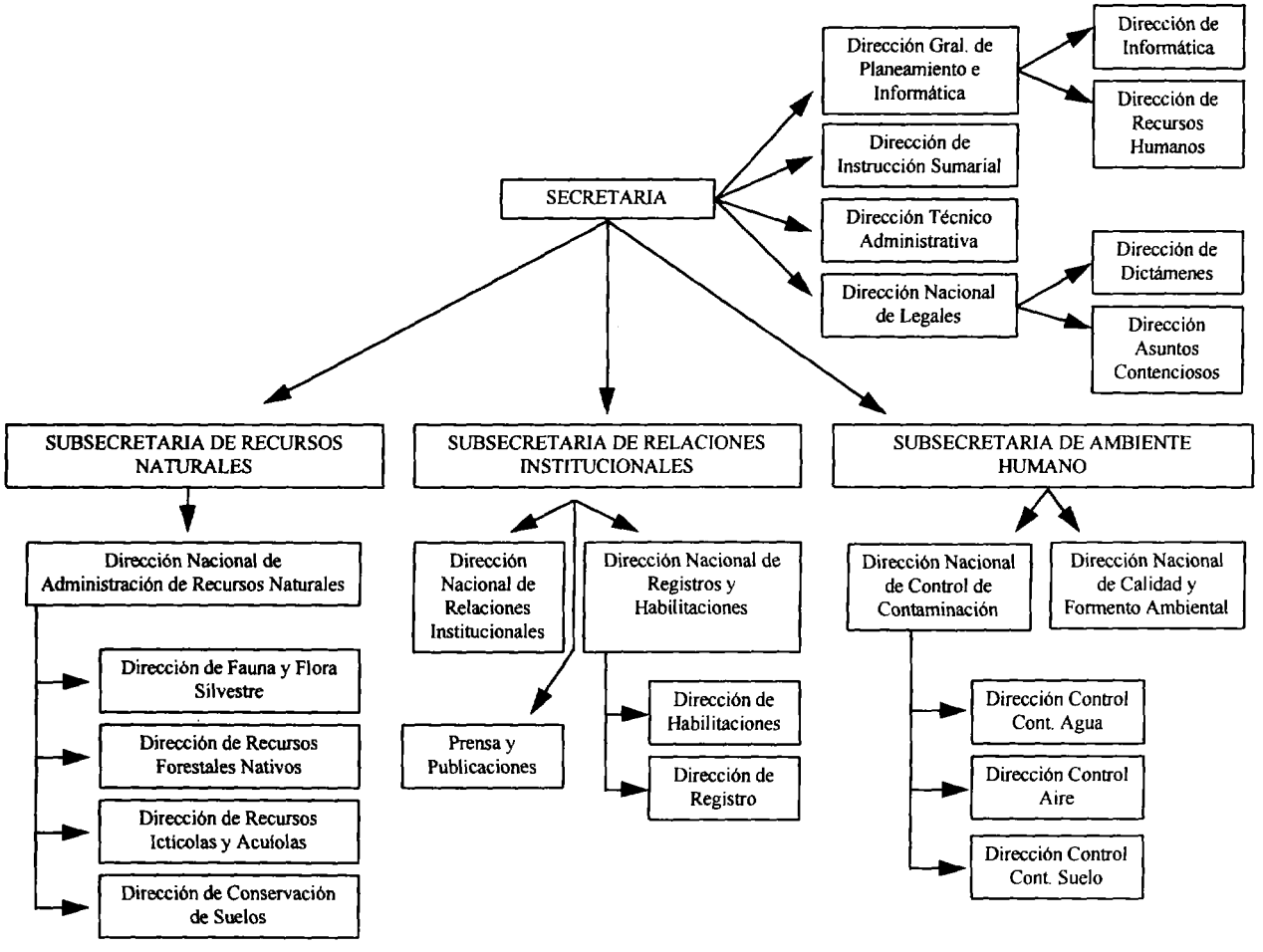
6.11 The common theme running across these five elements is the importance of minimizing the risks of incentive failures in the design of the internal organization of public institutions.[82] The main sources of incentive failures covered here are the multiplicity of objectives characterizing most government agencies, mismatches between responsibilities and physical or financial resources and information asymmetries between polluters and government agencies. All tend to result in inefficiencies and inequities in the implementation of environmental policies. The rest of the chapter shows to what extent Argentina these lessons of experience may be applied in Argentina.

The Current Institutional Situation

6.12 In principle, most environmental matters are the responsibility of the provinces, unless expressly delegated to the national government. However, under certain circumstances, the national government can assume authority for specific environmental issues. Environmental authority at the national level includes, among

82. Laffont, Jean-Jacques, and Tirole, Jean. A theory of incentives in procurement and regulation, Cambridge, Mass, MIT Press, 1993.

Figure 8: Organization Chart of SERNAH



others, responsibility for interprovincial waterways (i.e. the major rivers), and the construction of hydro-electric plants.

6.13 *National Agencies.* The national organization of environment policy centers around the Secretaría de Recursos Naturales y Ambiente y Humano (SERNAH), a cabinet level agency reporting directly to the president and with a total staff of 359. It is generally expected that SERNAH will become a full fledged ministry within a short period of time. SERNAH includes subsecretariats for institutional relations, human environment, and natural resources, the National Parks administration, as well as the *Instituto Nacional de Ciencias y Técnicas Hídricas* (INCYTH) (see Figure 8). SERNAH's 1994 budget is about US$24.5 million (33% personnel, 14% projects and studies, 14% pollution control, 10% administration of national resources, and 13% operating and administration costs). The development of SERNAH is supported by an IDB project (Environmental Institutions Development Project; US$30 million over 5 years).

6.14 SERNAH is working on a reorganization of environmental policymaking in Argentina but it has not yet had enough time to deliver in many areas. At this stage, it is still an evolving institution, struggling to define its role in the new institutional environment. SERNAH desires to set minimum national standards than can be tightened but not loosened by individual provinces. In fact, there are still few national guidelines. So far, SERNAH has been managing by consensus. Any actual or potential crisis leads to negotiation. The main disadvantage is that it takes time. This may explain why it is taking so

Box 15: National Agencies with Environmental Responsabilities

SERNAH is not alone in dealing with environmental issues at the national level. Just to illustrate the complexity of the system, here is a partial list of other agencies involved: The Ministry of Economy and Public Works has a say in policy guidelines in agriculture, mining, fishing and energy. Through the Planning Secretariat, it manages the EIAs for public investment. The Education Ministry is responsible for environmental education. The Interior Ministry is involved in issues raised by interprovincial rivers. The Ministry of Defense is also an active player. The Air Force and the Navy monitor air and water contamination. The Prefectura Nacional Marítima polices environmental pollution through (i) Servicio de Salvamento, Incendio y Contaminacion (SERSICO); (ii) Control de la Contaminación de Aguas Portuarias y Vías Navegables; (iii) División Mercancias Peligrosas are active in monitoring and policy related issues. The Policía Federal is involved in enforcement through the Division Preservación Ambiental, Recursos Naturales y Delitos Ecológicos. The Ministry of Health and Social Action through its Housing and Environmental Quality Secretariat sets and enforces norms on pollution, resettlement, environmental impacts of infrastructure projects and manages the registry of polluting sources. The Ministry of External Relations and International Trade addresses international aspects of the environment. The Secretariat of Agriculture, Cattle and Fisheries does environmental research through its Instituto de Technologia Agropecuaria (INTA). Other public agencies involved include the Consejo Federal de Agua Potable y Saneamiento (COFAPYS), the Servicio Nacional de Agua Potable (SNAP), the Coordinación Ecológica Area Metropolitana (CEAMSE), and the Comision Nacional de Energia Atomica (CNEA). The most recent additions to this list are the recently created regulatory entities in electricity, gas and water. All have environmental units responsible for monitoring the environmental requirements of concessions contracts but not all have the same powers. For instance, while the energy entity is allowed to charge fines, the water entity is not.

long to prepare a general environmental law and a National Environmental Action Plan. In view of the long agenda of things to do in the sector, this may not be the best solution.

6.15 SERNAH is not alone in dealing with the environment at the national level. The number of other national agencies is quite large as seen in Box 15. The fragmentation of responsibilities is one of the weakest points of Argentina's environmental management framework. It multiplies coordination difficulties and conflicts of interests in the disputes over resource allocation. Problems are aggravated by the fact that the ultimate responsibility for any problem is seldom clear in the law.

6.16 *National-Provincial Coordination.* National-provincial relations are complex. As a common practice, the national Government enacts laws applicable in its jurisdiction, and then invites the provinces to adhere to such law. If the province decides to adhere to the national law (or decree, regulation, standards, etc.), it may adopt such law in total or in part. The province determines also the provincial authority which will implement such law or it may delegate the powers to implement the law to the municipalities.

6.17 A case that illustrates the complexity of national-provincial relations is the national Hazardous Waste Law 24.051 of 1992. This law covers the generation, manipulation, transport, treatment and final disposal of hazardous waste. Provinces are invited to enact their own laws but, to date, only Mendoza, Chubut and Tierra del Fuego have formally done so. Other provinces, which already have fairly detailed laws and want to preserve their prerogatives in matters of

environmental management, have contested the national law. The issue here has been more on of form than of substance. Several provinces desire to assert their independence from the central government. As a result several provinces have their own laws on hazardous waste, and the national law only applies in a limited area around Buenos Aires and interprovincial waterways and roads.

6.18 At the level of national-provincial relations, SERNAH hosts the Consejo Federal de Medio Ambiente (COFEMA), the forum in which all provinces and the national government discuss common themes. In 1993, SERNAH successfully negotiated an environmental pact ("*Pacto Ambiental Federal*") with all the provinces. This pact is a political instrument that signals the willingness to coordinate provincial and national efforts. So far, few provincial congresses have ratified the Environmental Pact. Yet ratification will be necessary for any full endorsement of the minimum standards SERNAH will have to design as a result of the latest constitutional changes. Another informal coordination mechanism exists in the Parlamento Ecológico, a group consisting of parliamentarians from both chambers of Congress as well as provincial legislatures. There are specific instances of interprovincial collaboration on individual pollution issues such as the interprovincial agreement on the Colorado river (COIRCO).

6.19 *Provincial Agencies:* At the provincial level, the capacity for the management of environmental problems differs widely. Córdoba, Mendoza, Santa Fe, and Buenos Aires are considered the provinces with the best institutional conditions for efficient environmental management. Provinces have their own constitution which regulate the division of provinces into municipalities and determine the latter's competencies in environmental management. Therefore, power distribution between provinces and municipalities differs across provinces. The main role of municipalities is to enforce the regulations, but few seem organized, equipped, financed or staffed to do this. The overall picture on the intergovernmental allocation of responsibilities is also confused because many changes are still taking place and there is no clear vision of where these changes are leading.

6.20 Examples of provinces with advanced environmental management include Mendoza and Córdoba. The Province of Mendoza has a Ministry of Environment, Urbanization and Housing with an annual budget of US$17 million. Its programs include an environmental warning system, compulsory use of CNG for public motor transport and an Environmental Preservation Law that requires annual reporting on environmental management and makes EIA mandatory. The Province of Córdoba has an undersecretariat for environment with a US$0.5 million budget. Currently modifications to the provincial environment law are underway. A commission to address problems of the basin of the Lake San Roque has been formed and a pollution prevention program initiated.

6.21 The Capital Federal is not part of the Province of Buenos Aires but directly administered by the president through an appointed mayor. Congress and a popularly elected city council share legislative powers over the Capital Federal. The city administration includes a unit for environmental management that is struggling hard but does not have the resources to deal comprehensively with the environmental problems of the city. There are no formal institutions for metropolitan management in AMBA.

6.22 A partial summary of institutional responsibilities and applicable regulations is provided in Table 24. In general, the provincial standards are adapted from national standards. These in turn have been adapted from developed countries standards. For example, the national basic air law from 1973 is partially based on the U.S. Clean Air Act. This law is an example for legislation that was never regulated and has never been effectively implemented.

Table 24: Summary of Environmental Regulation and Institutions

	National	Provincial	Municipal
Water	GUIDELINES. Jurisdiction over national waters (1989 Decree); civil and criminal codes for water resource protection. MONITORING of national waters through SERNAH; random checks by Ministry of Health; ETOSS monitors emissions of AA. ENFORCEMENT. SERNAH has enforcement power for national waters; Navy enforces in international waters (ocean,Rio de la Plata).	GUIDELINES. Jurisdiction over intra-provincial waters. MONITORING through provincial environment or health agencies; increasingly role for water-basin organizations ENFORCEMENT in provincial waters; i.e. Province of Buenos Aires has Policía Ecologica.	GUIDELINES. In some provinces, grant permits that need to be approved by province. MONITORING delegated to municipalities by most provinces.
Air	GUIDELINES. Basic air law from 1973 never regulated. MONITORING AND ENFORCEMENT is, in theory, role of the Ministry of Health.	GUIDELINES. Provinces have not adhered to national law; some have own law.	GUIDELINES through municipal ordinances. MONITORING AND ENFORCEMENT. Car emissions are controlled through random spot checks.
Hazar-dous Waste	GUIDELINES. Basel Convention ratified; national Law 24.051 of 1992 and regulation by SERNAH; currently applies only in GBA and for interprovincial transportation. MONITORING AND ENFORCEMENT by SERNAH; includes hazardous waste register.	GUIDELINES. Few provinces have adhered to national law; several provinces have their own hazardous waste laws.	
EIA	GUIDELINES. National Public Investment Law requires EIA for selected public sector projects; additional sectoral requirements (dams, energy, mining, etc.).	GUIDELINES. Several provinces have own EIA laws.	

Issues with the Current Management System

6.23 The general picture, considering the role of the national, provincial, and municipal government is one of interjurisdictional conflict. The legal requirements differ among themselves and the several authorities compete in the application of the law. Enforcement ends up being arbitrary since it is often based on crisis but seldom leads to dramatic improvements in the overall management of the environment. The current design of pollution control in Argentina raises two main issues: (i) the fragmentation of the organizational and policy design increases uncertainty and hence enforcement and compliance costs; and (ii) coordination mechanism are generally too informal to be effective and have a consistent outcome.

6.24 *Institutional Fragmentation.* The fragmentation of the design of national environmental institutions and policies in Argentina is at the core of environmental policy failures. It fuels all other institutional issues discussed later. Many firms are not sure of what law they are supposed to comply with. For

instance, representatives of the leather industry in Avellaneda (Prov. of Buenos Aires) complain that they are subject to six types of environmental related inspections and that to many of them, the specific requirements to be met for each one of these inspections is unclear. Even if the specific purpose of each one of these inspections is clear to the authorities, the confusion about applicable environmental norms revealed by potential polluters should be a source of concern. On the government side, no one really has the ultimate responsibility for success but failures tend to be blamed on SERNAH even though responsibilities may be shared.

6.25 *Coordination Mechanisms:* The multiplicity of the agencies involved creates coordination problems and inconsistencies in injunctions to polluters. A recent incident in GBA left half a dozen people dead from toxic leaks in the sewerage pipe system. Many agencies were probably sharing responsibility. Over a year later, no one has officially been blamed. This confusion in regard to responsabilities makes is difficult to enforce environmental standards.

6.26 The regulation of water pollution involves the greatest degree of institutional complexity. For instance, if a firm discharges polluted water into a sewer operated by Aguas Argentinas (AA) in GBA, AA may ultimately have to absorb the increase in treatment costs that results from that pollution. The discharges of AA are strictly regulated by the concession contract and it is tightly controlled by the water regulatory entity (ETOSS). In the process of avoiding violation of its contract, AA ends up contributing to the monitoring role by checking emission of the firms discharging in its collection system. However, when it finds violators of emission standards that are likely to lead AA to violate its own emission standards, AA has to rely on SERNAH to get the polluters to remedy their actions. The original polluters can negotiate with SERNAH an extended timetable to fix these problems, yet AA is still expected by ETOSS to meet its emission standards at all times. This discrepancy between the timetable faced by the polluter and AA stems from the fact that the first is accountable to SERNAH only, while the second is also accountable to ETOSS through its concession contract.

6.27 An additional layer that is appearing are the water and basin committees (*Comité de Cuencas*) for each river system but almost none has yet been fully operational to date. The administrative obstacles to overcome in the Río Matanza-Riachuelo basin are typical of environmental policymaking: at least 22 institutions of all levels have authority over the basin. In the Río Reconquista the scenario is not much different: 13 municipalities plus the provincial and national governments exercise jurisdiction over the basin.

6.28 Provincial governments enforce the law for provincial waters, suggesting a high potential for overlap between the national and provincial levels. For instance, the province of Buenos Aires has created an environmental section within its police department that works more closely with SERNAH than with the environment department of the province. In Buenos Aires, as in many other provinces, the provincial Ministry of Health has also enforcement powers through its *Dirección Provincial de Medio Ambiente.* Since in many provinces, environmental agencies (ministries, secretariats or sub-secretariats) are still relatively new, there are still some overlapping problems between them and health agencies who used to be responsible.

Steps Towards a Reform of Environmental Institutions

6.29 SERNAH is aware of many of the problems and of the necessity to streamline the design of environmental policy in Argentina. It is very actively working at reorganizing its institutions to establish a more transparent and ultimately more effective national environmental system. This effort includes the work on a national environmental policy, a national action plan and a national information system. However, progress has been extremely slow. The expected transformation of SERNAH into a Ministry could provide an opportunity for a more thorough

reorganization of functions and a concentration of responsibility for policy setting in one agency. The rest of this section offers some suggestions for reform of policy, monitoring and enforcement areas aimed at fueling and maybe accelerating the ongoing debate in Argentina.

6.30 Overall, based on a comparison of the situation in Argentina with lessons from the international experience, the development of a simpler and more effective institutional framework for environmental management will require: (i) the decentralization of policy making to provincial and municipal levels combined with its concentration within any level, (ii) the decentralization of monitoring and enforcement, (iii) the use of effluent fees and other environmental charges to provide incentives for the implementation of the least cost solution in terms of behavioral changes and investments to minimize wastes, and mobilize resources for environmental monitoring, enforcement and services, (iv) a stronger role for the legal system, (v) increasing the participation of the public in environmental decision making, and (vi) the improvement of environmental monitoring and analysis to provide a better basis for decisionmaking on environmental policies.

6.31 *Decentralization of policymaking with national minimum standards.* The case for decentralization is based on the fact that the provinces are often much more aware of the local environmental issues and of the local capacities to deal with these issues. This suggests that the identification and selection of environmental goals and policy instruments should best be done at the provincial level. A single agency needs to be established to take responsibility of environmental policy in each province. This conclusion has already been reached by the govern-ment of Mendoza (Box 16). Not every province needs to be organized in the same way. In provinces where the main environmental problem is one of soil erosion, the agriculture ministry may be the best host for an environmental department or secretariat. There will still be environ-mental units in different ministries and coordination of across ministries will remain an important determinant of the success of environmental policies. The point is, however, to ensure account-ability by allowing the clear identification of an ultimate authority in environmental matters.

6.32 In many cases, the provincial governments should be able to rely on national guidelines as minimum regulatory requirements. Since September 1994, the national government has a constitutional mandate to produce minimum standards for air, water and waste. The existence of these national minimum standards would reduce the risk of competition for investment between provinces or municipalities based on the minimization of environmental requirements.

6.33 *Decentralization of Monitoring.* A full decentralization of monitoring capacities may not be the most desirable option but a clearer and more systematic division of these responsibilities with the provinces and the municipalities would be a more effective solution. Decentralization of monitoring brings this function closer to the authorities who are closest to the information required. For provincial water bodies provincial monitoring is likely to be cheaper and more effective. For the air pollution problem, unless there are spillovers and if there are no institutional or technical limitations, municipal monitoring may be most effective.

6.34 Provincial monitoring quality may not be consistent with the national minimum standards, and random checking by the national government may be important to avoid the consequences of inter-jurisdictional competition or to hedge against the limited capabilities of some of the provinces. The problem of lacking provincial capabilities could be addressed by subsidies for monitoring to provinces (direct or through matching grants where the matching component could focus on the training of provincial staff).

Box 16: Institutional Reform of Environmental Management in Mendoza

The province of Mendoza has had a Ministry of the Environment since 1989. The government understands that its existence does not guarantee the quality of an environmental policy or of its implementation. The Ministry still often lacks the financial, political and institutional autonomy to take on its responsibilities. This is why Mendoza is now moving towards the creation of an autonomous environmental agency with its own sources of funding.

The agenda of reform in this transition has focused on the consolidation of environmental management and institutional building. It includes the coordination of interjurisdictional efforts within the province (with municipalities) and with the national level, the compatibilization of rules and laws (both within and outside of the provinces) and the improvements of relations with the academic and scientific community to support the efforts to identify problems and to train civil servant in the area.

The institutional set-up include autonomous substructures: sanitary work, housing, trolleybuses, public transports, urban environmental planning, environmental control and sanitation, natural and renewable resources and parks and zoos. Each one of these areas is identifying the problems in its area of responsibility, defining its own actions and thus defining the basis of a provincial environmental plan. The definitive institutionalization of this is being formalized and is expected to be released early in 1995.

The specific funding mechanisms have not yet been identified but various options are being considered. One of them is the creation of an Environmental Fund. Surcharges for public services relating to pollution (monitoring, treatment,...) would be levied on polluters and be earmarked to this fund. All this is still very tentative but is it quite encouraging to see that Mendoza is doing its homework to guarantee the political and financial autonomy required from any agency involved in regulation and in the defense of the interests of the least organized segments of the population.

Source: Puliafito, J.L. (1994), "A South American Country Example: Environmental Legislation Enforcement in Mendoza - Experience and challenges", mimeo, IEMA, Universidad de Mendoza

6.35 Monitoring can be expensive both in terms of technical and human resources. Private sector service contracts can potentially reduce costs. A solution to reduce budgetary costs is to share part of the cost with the potential polluters by imposing some degree of self-reporting. A good example has recently been implemented in the power sector, where the privatization process is being used to elicit information on pollutant emissions by the sector. Within three months of taking over a generator, the private firm winning a bid is required to deliver a chart of all liquid effluents (quantities and qualities). Within six months a full environmental diagnostic was required. Also after six months, the firm is expected to have installed in its chimneys instruments to measure NOx, SO_2 and particulates. The experience is still incomplete, but worth following up and maybe duplicating in other sectors.

6.36 A final option that seems to be increasingly considered by provinces and municipalities is to rely on monitoring by the population. The use of a "green hot line" is becoming an increasingly common solution to identify problems. Citizens can call 24 hours a

day to inform a municipal or provincial environmental agency of a problem. A good example of creativity in the monitoring and enforcement area is Córdoba. It has its formal and informal green police. The informal police is composed of 1500 citizens that receive some basic training on how to identify problems. Most of this monitoring is visual, of course, but provides early warnings of potential problems. The informal force has both monitoring and enforcement powers for minor violations. The experience is very recent but the early reports are promising.

6.37 *Decentralization of Enforcement.* The lack of enforcement is a critical problem for most existing environmental regulations. Unless the reasons for the lack of enforcement are addressed, it is unlikely that additional regulation would be enforced more effectively. In many instances, the appropriate approach would be to give the agency charged with enforcement a fiscal incentive for pursuing their task. Revenue sharing of fines is one option. Procedures and regulations should be designed to ensure that compliance can be monitored and enforced. This is not always easy, in particular when enforcement is decentralized. Instruments need to be designed accordingly but it is often relatively easy to prioritize to be able to focus scarce resources on the key issues. This requires a strategy, the clear identification of target groups, the acquisition of technologies matching local capacities, the definition of clear performance criteria for these target groups, the development of a database to be able to link fines to previous violations of the law and often some degree of self monitoring. But feedback may also be obtained from a more extensive public involvement.

6.38 As an example of how decentralized enforcement could be approached, the province of Buenos Aires established a green division (30 staff) of the Provincial police, with a mandate to enforce environmental laws. It acts on its own (*ex-officio*) or when required by the Judiciary or one of the agencies. It has been working closely with national authorities (SERNAH and judges), although formally its jurisdiction is of a provincial nature. Since its inception two years ago, it has conducted 630 investigations, which resulted in fines or closures imposed by administrative and judicial authorities.

6.39 *Use of Environmental Impact Assessments.* The Environmental Impact Assessment (EIA) is one of the critical instruments of environmental regulation, particularly for addressing major environmental impacts, cross-media issues, and projects involving resettlement of the affected population. A promising instrument for making the EIA process more transparent and efficient is the application of social damage costs for comparing environmental damages with project benefits. One of the requirements for the EIA would be to show that the investment project is economically viable when taking its environmental and social externalities fully into account. To facilitate the preparation of EIAs, the responsible government agency should develop estimates of shadow prices for environmental damages (i.e., a monetary amount per ton of each pollutant) from economic analysis (including, initially, studies of damage costs or abatement costs done in other countries). Ultimately, shadow prices should be regionally differentiated to reflect local conditions with different levels of damage costs (e.g., taking into account meteorological conditions and the diluting capacity of the local water bodies.).

6.40 In Argentina, EIAs are required in about half a dozen provinces, and at the national level, the new Public Investment Law requires EIA for selected public projects or projects with public contributions or guarantees. However, the implementing regulations have not yet been issued (see Box 17).

Box 17: EIA in Argentina

The new national public investment law requires EIA for selected public projects or projects with public contributions or guarantees. The provinces and the municipalities can have their own requirements with respect to this instrument which means that while there is no national EIA, in some parts of the country investors already have address local requirements as in Córdoba, Neuquen, Rio Negro, Mendoza, and Tierra de Fuego.

A more systematic use of EIA is essential to ensure the comprehensiveness and quality of environmental management. Perhaps some experiences could be drawn from the energy sector, where EIA has been required since 1987. Lack of training is a major problem, to carry out EIAs on a provincial level. It took Córdoba for instance about a year to put in place the procedural requirements (including weekly meeting to discuss demands and a formal and informal set of reviewers of assessors) and train municipal administrations in understanding the value and importance of the instrument.

6.41 *Funding Environmental Management Responsibilities.* The capacity of the government to intervene through enforcement of regulations, effluent fees, financial incentives, investments or other types of policy instruments depends on the resources available to the government makes on administrative and monitoring capacity. There are several options available to mobilize these resources. For most environmental agencies in Argentina, the current practise is to rely on general revenue and to allocate resources through the regular budgetary process, with occasional supplementary allocations. In most cases however, there is a perception that the revenue allocated do not cover the expenditure requirements, with the result that the implementation of environmental policies is far below desirable levels.

6.42 An alternative is to recognize that environmental management is a service with well defined customers: the polluters and the beneficiaries of reductions in pollution levels. This provides potential sources of autonomous financing through the implementation of pollution charges and user fees. This approach, based on the "polluter pays principle", will, in general provide appropriate incentives for pollution abatement, lead to the full recovery of the costs of waste removal, treatment and disposal, discourage the use of environmentally damaging products, and encourage the recycling and reuse of materials. In addition, the implementation of user fees will mobilize financial resources to support the monitoring and enforcement of environmental policies.

6.43 The institutional responsibility for this approach would be at the same level as for environmental management. Basically, the funds would be collected by the providers of the service, at the national, provincial and municipal levels, and used exclusively to cover the costs of the service, including investment and operating costs. A good example of the implementation of the proposed approach are the waste water charging system in France (See Box 18).

The Role of the Legal System in Environmental Management

6.44 While a discussion of legal reform is out of the scope of this report, the review of institutional requirements for environmental management points to two key legal aspects that

Box 18: Water Management Charges in France

In 1964 France transferred the responsability for the management of water resources and the control of water pollution to two new types of institutions: (i) river basin committees, that would be in charge of establishing water quality standards, and (ii) basin water agencies, that would be responsible for water management and pollution control policies. Six pairs of such institutions were set up to cover the entire country.

An important aspect was the introduction of a system of volume-based water use and effluent charges that fully reflect the treatment costs of specific pollutants (suspended matter, oxygen demand, inhibiting substances, organic and ammoniac reduced nitrogen, phosphorus, soluble salts, halogenated hydrocarbons, and toxic metals) in each basin's own treatment plants. Revenues are exclusively used to fund investment and operating costs of the treatment facilities, and to provide financial incentives (below-market credits) for pollution abatement by private firms.

Since the program started, the treatment of sewage increased from very low levels to 70%, and the treatment of industrial effluents to 85-90%.

Source: Use of Pollution Charges in Water Management in France, Background Paper No. 4, Informal Workshop on the "Use of Economic Instruments in Environmental Policies", OECD, Paris, 1993.

deserve some attention, (i) the need for a general law on the environment, and (ii) the need to strengthen the role of courts and mediation services in improving the overall legal support of policies.

6.45 *A General Environmental Law.* The critical jurisdictional issues that have constrained effective environmental management in Argentina could be clarified with a law that defines the national environmental system, i.e. the roles and responsibilities of the federal and provincial governments in regards to environmental policies and management. This law would have to be consistent with the 1994 Constitution's requirement that the National Government dictate "minimum requirements," but respect the "local jurisdictions". Examples of such laws already exist in Honduras, Brazil and Peru). In addition, the law should provide a sound legal basis for the introduction of effluent fees, and other economic instruments for environmental management, by establishing the general principle that the state has the right to charge those that use the country's natural and environmental resources, i.e., the "polluter pays" principle.

6.46 *Strengthening the Role of Courts and Mediation Services.* Until recently, courts in Argentina had not been very sensitive to environmental claims. This stemmed from: (i) the weakness of environmental education and awareness in the judiciary power; (ii) the narrowness of the legal coverage of the field; and (iii) the modest reliance on the judiciary by the civil society. Moreover, the civil law tradition to which Argentina belong, limits the role of the courts in the interpretation of the law.

6.47 Recently, some courts have taken a more active role. A recent incident in Gran Buenos Aires, in which toxic fumes released in the sewerage system killed several people, had a catalyzing effect on the judiciary. A few judges are starting to take the lead and making rulings revealing a genuine concern for the environment that would have been inconceivable a few years back. The National District Court No.1 based in San Isidro has been very active in trying cases involving the 1992 Hazardous Waste Law. The

Court of Appeals of La Plata recently granted $18,000 to two children who suffered from respiratory infections caused by a nearby industry. The judgement was partly based on moral harm and not just physical harm. The People's Defender and the Public Ministry could, and may, become active environmental actors in Argentina's courts.

6.48 Although the judiciary is progressively moving in the right direction, there are still many enforcement problems in Argentina. A random interview of parties involved in environmental litigation suggests that the legal process is excessively formal and hence slow. There is also a perception of inadequate understanding in environmental law within the legal system, including knowledge of techniques for obtaining and preserving evidence of environmental damage. Finally, an overwhelming case load, with the attendant delays and other costs, points to the desirability of developing a sound legal framework for mediation and arbitration services, combined with a simplification of civil procedures.

The Management of Environmental Information and Participation

6.49 *Environmental Information.* The international experience suggests that dissemination of information is important because it reduces the risk of unbalanced decisions that could result from the polluters' informational advantages. They often stand to gain the most from a limited access to information by populations at large and by potential victims in particular. Limited access to information leads to inefficiently high level of pollution with potentially strong health impacts. Information is needed not only to inform the public, but also to define Argentina's long term environmental strategy, including a better sense of priorities. One of the reasons why pollution control efforts are driven by crisis management rather than by an analytically based sense of priority is that there is hardly any data on ambient pollution levels and the attendant consequences on health, productivity and amenity values.

6.50 The general development of government monitoring of existing sources of pollution is clearly important to develop a strategic capacity as well as a minimum level of enforcement of environmental laws. This requires, from all government levels, a willingness to compile statistics on the environment with a regularity and a commitment similar to that given to the production of budgetary or financial data. This is a complex task since the commitment to performance indicators in the public service tends to be weak. This is clearly an item for technical assistance for the national government to the provincial and local governments.

6.51 The second approach to the generation of information is to collect it as new projects with environmental impacts come up. Currently it is difficult to get properly structured compilations of the results of EIAs where those have been conducted. The raw material (i.e. the detailed technical assessment of the environmental impact of a project) is often available but they are of little use for policy-related decisionmaking and for those in the population who may be affected by a specific project. EIAs need to be processed, digested and transformed into information rather than being kept as raw data. Better environmental information can be one of the payoffs of EIA as well understood by the Province of Cordoba where EIA is leading slowly but progressively to an inventory of pollution sources and types.

6.52 *Public Participation.* So far public participation in environmental management has been very limited. The problems in finding a suitable location for a hazardous waste treatment plant demonstrate amply how pollution problems can be aggravated by lack of local participation. Positive examples include the environmental impact assessment process in Mendoza, which includes public hearings. Open access to information is in important condition for effective public participation in environmental management. International experience suggests that the EIA offers a good opportunity to improve dissemination of information and to identify concerns and needs. Public involvement in

Box 19 Public Participation in Establishing Environmental Regulations in the United States

According to the Administrative Procedures Act, The U.S. Environmental Protection Agency (EPA) must ensure that the public is informed of all proposed regulatory actions. First, the EPA must give notice of a proposed action to the public by publishing it in the Federal Register, a daily publication containing proposals from all federal agencies. The public then has the right to comment on the proposed rule. The comment period must be at least 30 days. In the case of major or controversial proposals, the comment period may be 60 or 90 days or more, with numerous public hearings held around the country. When drafting the final rule, the EPA must consider the data and information gathered during the comment period. The final rule may look exactly like the proposed rule or be modified substantially. It is not uncommon for this process to take as long as five years from the drafting of the initial proposal to publication of the final rule.

The most important factor slowing the regulatory process is the threat of or actual litigation by industry, environmental groups, or both. Because of the high probability that a rule will be challenged, EPA has developed a process called regulatory negotiation, which tries to bring together all of the interested parties before the "proposed rule" stage. All parties must agree that if a consensus is reached by the group, none of its members will litigate the final rule. Not all regulatory actions are good candidates for this process. In some cases there is so much hostility between groups that they will not meet or will not trust the other side not to litigate. Sometimes industry coalitions fall apart because one industry may benefit at the expense of another based on the regulation.

planing and implementing projects can be brought through consultation of affected population in public hearings, e.g., as part of the EIA process.

6.53 Participation of the public and other stakeholders has proven to be an effective tool for developing political support and sustainability for the setting of environmental standards. While rigorous technical analysis is an essential prerequisite, the usual absence of accurate estimates of environmental damages and attendant costs virtually requires consultation with the affected population and other interested parties to reach agreement on appropriate levels of pollution control. Experience in the US illustrates how such a process works in practice. (see Box 19)

6.54 Public participation is most effective when the public has been informed and educated on the environmental risks that it is exposed to, and the costs associated with alternative levels of pollution and pollution abatement. The Ministry of Education already has programs to get civil servants, teachers and the younger generations still in school to learn more about these needs and concerns. (See Box 20) Some municipalities are also devoting significant resources to the education of teachers, students, and the general population. In San Fernando (Prov. Buenos Aires), for example, a three-person team has managed to organize educational theaters with the participation of children. They are now working on a video version of the same show. The whole process is of course viewed as an investment in the long run, but there are also short term gains since the children are increasingly getting involved in recycling. While recycling is not profitable from a financial perspective, it has other types of tangible payoffs. Illegal dumping on natural playgrounds for children is reduced and related health hazards also.

6.55 NGOs are also very actively involved in generating information on the sector. Some of the best could play an even larger role, provided they

[illegible] of inadequate understanding in

Box 20: Argentina's Program of Environmental Education and Preservation

The program is an outcome of the requirements of the National Education Law. It defines pedagogical guidelines to try to achieve a common benchmark in the teachings on the environment for children enrolled in primary and secondary education.

The objective is to incorporate environmental awareness in the lifestyle of children and is perceived by many of those involved as a long terms investment in the country. It organizes seminaries for teachers (25 last year and 25 expected this year). This seminars are designed in such a way that they result in direct suggestions to address concerns raised by participants.

There are similar programs organized by Provincial and Municipal governments. The Municipality of San Fernando has very effectively organized various such sessions. Financing for municipalities comes from on sources but also frequently from private grants or gifts provided by Western Development agencies.

are willing to subject themselves to the same level of accountability they are demanding from the government. The sample of environmental NGOs found in Argentina is representative of those found in most other Latin American countries. Most have highly dedicated and motivated staff. Many lack the professional background and technical skills required to become a substitute to an official source of information on environmental matters. They have a potential important role in transmitting information and contributing to increase awareness on many environmental issues of very different types.

Recommendations

6.56 *Decentralization of Policymaking.* The case for decentralization is based on the fact that the provinces are often much more aware of the local environmental issues and of the local capacities to deal with these issues. This suggests that the identification and selection of environmental goals and policy instruments should best be done at the provincial level. On this basis, it is recommended that:

(a) each province designate a single agency to take responsibility for environmental policy. There would still be environmental units in different ministries and coordination of across ministries will remain an important determinant of the success of environmental policies. The point to ensure accountability by allowing the clear identification of an ultimate authority in environmental matters.

(b) the federal government establish minimum environmental standards to reduce the risks of competition for investment between provinces or municipalities based on the minimization of environmental requirements. Since September 1994, the national government has had a constitutional mandate to produce minimum standards for air, water and waste.

6.57 *Decentralization of Monitoring and Enforcement.* Most municipalities in Argentina already have the authority to monitor and enforce environmental regulations, but the general lack of enforcement is a major issue. To improve the effectiveness of decentralized monitoring and enforcement, it is recommended that:

(a) the federal government provide technical assistance to the weaker provincial agencies to bring their technical capabilities up to minimum standards, and verify the consistency of monitoring and enforcement through occasional random checks.

(b) the responsible agencies explore opportunities for reducing the costs of monitoring and enforcement through such approaches such as using private contractors, relying on self-reporting by firms (within the framework of government-industry sectoral environmental action plans), and reliance on monitoring and enforcement by the population, e.g., through the use of a green hot line or (as is in Córdoba) the use of voluntary "green" police.

(c) the governments provide a fiscal incentive to the agencies charged with enforcement by allowing them to keep a share of the fines they collect.

6.58 *Use of Environmental Impact Assessments.* The Environmental Impact Assessment (EIA) is an important instruments of environmental regulation, particularly useful for addressing major environmental impacts, cross-media issues, and projects involving resettlement of the affected population. In expanding and clarifying the use of EIAs, the following should be kept in mind:

(a) the purpose of EIAs is to improve decision making and the ensure that potentially controversial projects are implemented in an environmentally sound and sustainable manner. Therefore the EiA process should begin as early as possible, when major parameters of project siting and design can still be changed on the basis of the results of the process.

(b) while EIA's should be the responsibility of the proponents of the project, the environmental agency in charge of supervising the process should take an active role in facilitating the process, through formulating clear rules and timetables for the process, establishing an information base and appropriate guidelines for the evaluation of environmental damage, and preparing model sectoral EIAs as part of a cooperative effort with industrial chambers and other interested parties.

(c) to better understand the nature and extent of any social or environmental impact, and the acceptability of proposed mitigatory measures, it is important that the EIA process include consultations with affected groups and NGOs. These consultations are not intended to reduce the decision authority of the environmental agency, but are a valuable way to improve decision making and to increase community cooperation in implementing the recommendations of the EIA.

6.59 *Funding Environmental Management.* The capacity of the government to intervene through enforcement of regulations, effluent fees, financial incentives, investments or other types of policy instruments depends on the resources available to the government makes on administrative and monitoring capacity. There are several options available to mobilize these resources. For most environmental agencies in Argentina, the current practise is to rely on general revenue and to allocate resources through the regular budgetary process, with occasional supplementary allocations. In most cases however, there is a perception that the revenue allocated do not cover the expenditure requirements, with the result that the implementation of environmental policies is far below desirable levels.

6.60 An alternative is to recognize that environmental management is a service with well defined customers: the polluters and the beneficiaries of reductions in pollution levels. This provides potential sources of autonomous financing through the implementation of pollution charges and user fees. This approach, based on the "polluter pays principle", will, in general provide appropriate incentives for pollution abatement, lead to the full recovery of the costs of waste removal, treatment and disposal, discourage the use of environmentally damaging products, and encourage the recycling and reuse of materials. In addition, the implementation of user fees will mobilize financial resources to support the monitoring and enforcement of environmental policies. The relevant considerations have already been discussed in para 3.55.

6.61 *Strengthening the Role of the Legal System:* In view of the importance of having an efficient legal framework and court system to support the enforcement of environmental policies, the following steps are recommended:

(a) as suggested by the new Constitution, there is a great need for a general environmental law that would define minimum nationwide standards and clarify the respective responsabilities of the national and provincial level for environmental management.

(b) the overload of the court system should be alleviated through the official promotions of alternative mechanisms for the settlement of environmental disputes, such as mediation and arbitration.

(c) the court system's contribution to the resolution of environmental issues should be improved through the expansion of environmental training for judges and other legal professionals. This training should include the techniques for obtaining and preserving evidence of environmental damage.

6.62 *Increasing Public Participation.* In view of the importance of a participatory policy making process is an important tool for developing political support for and improving the efficiency and effectiveness of environmental management, the following is recommended:

(a) the strengthening of environmental education to increase public awareness of environmental issues and facilitate their positive involvement in supporting the implementation and enforcement of environmental policies.

(b) the establishment of a National Environmental Information System that would integrated the environmental data collected at the national and provincial levels, and make it accessible to the public. In addition to existing information, recommended new inputs to the information system were discussed in para 1.81.

(c) the use of the EIA process as an opportunity for informing and educating the public on controversial aspects of major projects, and identify concerns and needs of the affected population.

(d) the establishment of formal consultative mechanisms with the public and other stakeholder in relation to the determination of pollution standards, environmental priorities, and the formulation of an agreed vision for environmental management.

6.63 *The Need for a Common Vision.* Most successful governments have based their management of environmental concerns on long term planning including an identification of the key environmental problems of the country and an analysis of the design of menus of options to solve these problems. This form of strategic thinking based on a vision of the sector tends to help nascent environmental authorities build an increasingly broad base of support. The implementation of this vision then consists of

spelling out the marching orders for policy makers in a long range plan. Having recognized this, SERNAH is already planning to prepare a National Environmental Policy and Action Plan (NEPAP) that would define a vision of the environment common to the population and the economic actors. Given the wide variation of environmental issues across regions, the provincial and local authorities should be encouraged to initiate environmental action planning exercises of their own in parallel with the national effort. To ensure the success of this effort, it is recommended that the following be taken into account:

(a) the NEPAP should identify priority problems. Because resources are scarce, governments have to limit the number of problems to be addressed. Priorities need to be set based on (i) using transparent criteria such as number of people affected, effects on health, the poor, and economic productivity, and the irreversibility of ecological impacts, (ii) giving weight to expert opinion, and (3) taking into account the concerns of the general public and affected persons.

(b) the NEPAP should define priority actions through (i) a diagnosis of the underlying causes of environmental damage, and (ii) finding cost-effective solutions. Here again, the objective should be to limit the scarce resources available for environmental management to those solutions that can address the priority problems at a minimum cost.

(c) the NEPAP process should lead to effective implementation of the priority actions by (i) involving key stakeholders, including multidisciplinary teams from appropriate agencies within the government, and consultative mechanisms to take into account the views of interested parties and ensure broad public input, (ii) identifying monitorable performance indicators to measure the rate and direction of environmental change, and well-defined targets, and (iii) integrate environmental actions with broader developmental objectives and decision making.

(d) provincial and local governments should be encouraged to formulate and carry out environmental action plans of their own in parallel with the national effort. These local environmental action plans should diagnose the local environmental problems and establish the priorities for actions that are the responsability of the local level, e.g., in relation to the monitoring of ambient air and water quality and enforcement of emission standards, creation of regional coordination bodies (such as for AMBA), congestion management and development of public transport, changes in solid waste management, and land use planning.

7. Towards an Integrated Plan of Action

7.1 The demand for improved environmental management is growing in Argentina. A recent survey showed that 76% of the population believes that over the last 10 years the environment has deteriorated.[83] The same survey hints at the willingness to fix this: 48% of the surveyed would pay more taxes if the revenue were earmarked to environmental protection. Pressure for change also comes from the new outward and competitive orientation of Argentina's economy. Improved environmental management is becoming a necessity imposed by: (i) MERCOSUR ---which requires an harmonization of environmental legislation and regulation, of standards and of monitoring approaches to avoid distortions in competition rules-- and (ii) the perception of a concern for environmentally responsible production systems among the most developed of Argentina's trading partners--the European Union and the USA, for instance, account more than a third of Argentina's exports.

7.2 The lack of environmental quality data, together with lack of estimates of the benefits of pollution control have made it difficult to determine if decisions on environmental matters reflect real priorities in Argentina. This means that the scarce available resources for environmental pollution control might be used inefficiently. The government has essentially been reacting to pollution-related crises and other episodes that have rallied public opinion. Even then, there is no clear sense of what should be done first, how much control is desirable and what are the most efficient and effective policies to be used. Lobbying by interest groups, both polluting industries and affected communities and NGOs, further contribute for decisions being political only. Since priority problems and actions are not ranked, there is a strong incentive not to act at all in many cases.

83. Del Giudice, F.J. Guía ambiental de la Argentina, Espacio Editorial, Buenos Aires, 1994.

7.3 In Argentina, integrated environmental management is made difficult not only by the scarcity of information problems, but also by: i) the fragmentation of environmental policies across various sector agencies; and ii) the great autonomy of provinces relatively to the national government. Provincial autonomy makes national priorities difficult to establish, both because of inadequate collaboration and lack of comparative analyses of regional problems, as well as political pressure by provinces to have national priorities focused locally. Since environmental problems usually cut across sectors, no single agency has sufficient authority to decide on environment-related policy and investment priorities.

7.4 In the presence of these problems, the development of a shared vision between all actors is critical to the transition toward an integrated approach to environmental management. The formulation of a National Environmental Policy and Action Plan (NEPAP) could contribute significantly toward the development of this shared vision. As discussed in Chapter VI, a NEPAP would identify priority problems, define priority actions, and lead to efflective implementation of the agreed strategy.

7.5 The following sections outline the possible elements of a NEPAP or similar national policy effort. They include suggestions for principles of an environmental strategy, priority problems, priority intervention and ultimately a plan of action. These suggestions represent the judgement of the World Bank team and should not replace the described national process of determining environmental priorities.

The Principles of a Pollution Control Strategy

7.6 *Consistency with Global Economic Policies.* Given that there is wide consensus that pollution problems are important but not among the very top priorities of national policy, a pollution control strategy for Argentina needs to

be consistent with the overall economic management strategy for the country. This report recommends an environmental strategy that is consistent with the following objectives:

(a) *Maintaining Macroeconomic Stability and Increasing the Competitiveness of the Argentine Economy.* Given the current macroeconomic situation of Argentina, it is critical to achieve improved pollution control without excessively increasing the production costs of domestic enterprises. This report shows that significant improvements in environmental quality can be achieved at low cost, while a very high level of cleanup is associated with rapidly increasing pollution control costs. If efficient policy instruments are prudently used, the incremental costs of environmental improvements are limited. Thus, attention to the details of regulation, instruments, timing and their cost implications are required.

(b) *Poverty Alleviation.* Environmental policies that benefit particularly the poor deserve special attention. This includes the improvement of environmental conditions in low-income settlements. On the other hand, environmental policies that have potentially adverse effects on the poor must be carefully examined.

(c) *Focus on Private Sector Development.* Environmental policies should be consistent with the overall objective to streamline government bureaucracies and strengthen the private sector. Government agencies should focus on its regulatory functions, while private sector contractors can be used in cost effective environmental policy, for example, in pollution monitoring and supply of environmental services. Market-based instruments of environmental policy further shift the responsibility of policy implementation to the private sector. Policies need to address new demand for environmental regulation created by the far-reaching privatization program.

(d) *Decentralization of Government Functions.* Environmental policy that does not respect provincial autonomy and the trend toward decentralization of Government functions will not succeed. Decentralization implies the opportunity for better environmental management based on better information. At the same time, there remains an important role of setting guiding principles and coordinating policies at the national level.

7.7 *Use of Economic Principles in Environmental Management.* Efficient environmental management is based on the comparison of costs and benefits of environmental controls. If policies ignore the costs of environmental degradation, they will lead to unnecessarily large environmental costs. On the other hand, if environmental policies ignore the costs of environ-mental protection (e.g., of pollution abatement), they would lack political support and be left unenforced. Environmental economics provides the tools and methodologies for the systematic comparison of costs and benefits. Even where data is incomplete and a detailed evaluation of environmental damages is not yet feasible, economic principles can be used to determine policy priorities.

7.8 Economic analysis will help focus environmental policy on those problems where pollution costs are large and interventions are relatively cheap. In the long run, policies based on economic principles will lead to tangible pay-offs that will strengthen political support for environmental policy. The reason for environmental degradation in Argentina is a landscape of local pollution problems and infrastructure neglect. Economic analysis can help avoid the costly mistake to focus policies on the cleanup of a few showcases to high standards, rather than beginning by implementing the less

costly measures first across the variety of pollution problems.

Priority Interventions

7.9 As the prioritization of environmental problems has already been covered in Chapter I, this section focusses on the prioritization of interventions. Ideally, intervention priorities should be determined by comparing the social costs with the social benefits of each intervention. Only through economic analyses can trade-offs be assessed, and priorities be established using a single common denominator. However, the difficulties of obtaining all information required to perform a full benefit-cost analysis have already been discussed. While Chapters II-V contain examples of applied cost-benefit analysis, an overall evaluation of intervention priorities has to be based on a simpler procedure.

7.10 Despite data limitations, decision makers should at least be offered a sound analysis which presents them with consistent options on which to base their considerations. A number of alternative criteria and considerations for prioritizing interventions have been used in various countries. Initially, the same criteria used for prioritizing environmental problems and for select-ing instruments apply to the ranking of interventions. Thus Argentina may want to prioritize actions that will benefit the greatest number of people, or which will benefit mostly the poor, or which have multiple (ie. beyond strictly environmental) benefits, actions aimed at problems with greater effects on health, problems that are recurrent or with irreversible effects, and problems posing the greatest risk or uncertainty. Priority actions also have to be cost-effective, politically and administratively feasible, and conform to government investment budgets (i.e. financial capacity).

7.11 In practice, deciding on the most urgent interventions is a political process which is often based on the availability of funds, political visibility, balance of regional investments, the apparent willingness and readiness of local institutions to undertake an investment, and others. Three additional considerations are practically important in the selection of priority interventions. The first is the continuity of existing projects and programs. The government may find it cheaper and administratively easier to complete ongoing projects than to eventually interrupt and redefine actions. The second is the complementarity with other government priorities, both regional and sectoral. For example, environmental initiatives can result much cheaper and simpler to imple-ment if they become components of larger regional, agricultural or industrial programs. And thirdly is the need for structuring programs such that they achieve some early success, however modest, that serve to build the confidence and that can be replicated. For example, it may be useful to design an ad hoc core program targeted initially on one or two larger and highly visible polluters.

7.12 Table 25 presents the Bank's qualitative evaluation of the priority of a selected list of different interventions. The table evaluates the costs (in terms of financial resources as well as institutional capacity) and the benefits and their uncertainty. As in the case of priority problems, (Table 7) these evaluations are fraught with uncertainty, and subject to revision whoever better information becomes available.

7.13 The evaluation of uncertainty in the determination of priorities merits more careful consideration. The costs of both air pollution and toxic pollution are highly uncertain. In the case of air pollution, systematic air quality monitoring is recommended before major policy initiatives (beyond "good housekeeping") are implemented. The reason is that the required studies are relatively easily completed and it is known from international experience that these studies will allow the determination of the health damages from air pollution within relatively narrow bounds, and thus a more reliable evaluation of air pollution control policies. In the case of toxic pollution, the uncertainty about pollution damages and costs cannot be as easily reduced with the completion of studies. There is much more uncertainty about the long-term health effect of exposure to toxic substances that is

unlikely to be resolved soon. In light of the high potential damage and the irreversibility of damages, the implementation of pollution control policies has priority over more detailed studies.

7.14 For the evaluation of some proposed intervention, it is necessary to take into account not only the benefits resulting from reduction in pollution. For example, the investment in water supply and sewage systems leads to increased amenity of running water. The value of these amenities by far exceeds the benefit of reduced exposure to pollution. Similarly, some transport management policies (for example measures that encourage the use of public transport) lead to benefits, such as reduction of congestion, that are likely to outweigh the benefits of pollution reduction. These additional benefits have been taken into account when determining the evaluation of intervention benefits in Table 25.

Recommendations for a Plan of Action

7.15 Tables 26-28 summarize the recommendations for action that follow from the analysis in this report. Wherever feasible, the degree of priority (high, moderate, or low), the institutional responsibility, the time frame for implementation, and a reference to the more detailed discussion in the text of this report are provided. The recommendations have been organized into three categories: (i) policy reform and management, (ii) research, information and analysis, and (iii) investment.

7.16 The strategy that emerges is consistent with the overall economic strategy for the country. Most investments for environmental improvements will be undertaken by the private sector in response to the appropriate changes in the regulatory and incentive structure. In the water sector, tariff reform would strengthen water companies' access to financing from the capital markets. Improved regulation and enforcement for industrial pollution control will, in principle, put the burden of investment on the polluter. In some cases of industrial pollution, financial inientives can be justified in order to ease monitoring requirements (see para. 6.35) and improve political acceptability of improved pollution control policies. Hazardous waste facilities are likely to attract private investors once the regulatory framework is sufficiently reliable to generate predictable demand for these services. Sanitary landfills, outside of AMBA, require significant investments by municipalities or, preferable, private sector operators.

7.17 *Potential Support from the World Bank.* The ongoing program of World Bank could support the environmental policy agenda with financing in the following areas (including references to recently completed tasks):

(a) The largest investment requirements are in the water and sewerage sector. Future projects would provide financing for service expansion of provincial water companies and advance the detailed policy agenda defined in the World Bank Water and Sewage Sector Note, including improved management and further commercialization of the water and sewerage sector. Support for studies recommended in this report (i.e. a sewage treatment and disposal plan for AMBA) would be included.

(b) In the area of industrial pollution control, most investments would be undertaken by the private sector. As a complement to ongoing regulatory improvements, and the establishment of agreed government-industry sectoral environmental action plans, a project could provide financing for pollution control/prevention investments and technical assistance for SMEs.

Table 25: Prioritization of Recommended Interventions

Priority Interventions	Signifi-cance of Problem	Interven-tion Costs	Interven-tion Difficulty	Interven-tion Benefits	Uncertainty of Benefits	Overall Priority
A. Water Supply and Sewerage						
Policy						
- Water and sewer tariff reform	High	Low	High	High	Moderate	High
- Regulatory incentives for efficiency and privatization	High	Low	Moderate	High	Low	High
- Low cost technologies for poor	High	Low	Moderate	High	Low	High
Analysis						
- Least cost sewage treatment strategy for AMBA	Moderate	Low	Low	Moderate	Moderate	Moderate
- Groundwater study for AMBA	Moderate	Low	Low	Moderate	Low	Moderate
Investment						
- Expansion of water supply and sewage collection	High	High	Low	High	Low	High
- Sewage treatment	Moderate	High	Low	Moderate	Low	Low
B. Industrial Pollution Control						
Policy						
- Clarification of environmental rules through Sectoral Action Plans	High	Low	Moderate	High	Moderate	High
- Financial incentives for SMEs	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
- Effluent fees for all discharges	High	Low	Moderate	High	Low	High
Analysis						
- Least cost industrial pollution control strategy for AMBA	Moderate	Low	Low	Moderate	Low	Moderate
Investment						
- Hazardous waste treatment/disposal facilities	High	Moderate	Moderate	High	Low	High
- Pollution reduction through clean processes and treatment plants	Moderate	High	Low	Moderate	Moderate	Moderate
C. Vehicle Pollution and Spatial Management						
Policy						
- Emission standards enforcement	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
- Pollution-adjusted fuel taxes	Moderate	Low	Low	Moderate	Low	Moderate
- Measures to reduce congestion and promote public transport	High	Low	Moderate	High	High	Moderate
- Coordinating body for AMBA	Moderate	Low	Low	Moderate	Moderate	Moderate
Analysis						
- Systematic monitoring of air quality	High	Low	Low	High	Moderate	High
- Master plan for public transport	Low	Low	Low	Moderate	High	Low
- Land use planning for urban areas	Low	Low	Moderate	Moderate	High	Low
Investment						
- Bus lanes, intermodal exchanges	High	Moderate	Moderate	High	Moderate	Moderate
- Rehabilitation of subways and suburban railways	High	High	Low	High	Moderate	Moderate

D. Solid Waste Management						
Policy						
- Solid waste collection fees	Moderate	Low	Moderate	High	Low	High
- Technical guidance and financial incentives for municipalities	Moderate	Moderate	Low	Moderate	Moderate	Moderate
- Waste collection by neighborhood associations and NGOs	Moderate	Low	Moderate	Moderate	Moderate	Moderate
Analysis						
- Economics of formal recycling	Low	Low	Low	Moderate	Low	Low
Investment						
- Sanitary landfills	Moderate	Moderate	Low	High	Low	High
E. Institutional Framework						
Policy						
- Consolidation and decentralization of responsibilities	High	Low	Moderate	High	Moderate	High
- Strengthening of legal system	High	Low	High	Moderate	Moderate	Moderate
- National Environmental Policy and Action Plan	Moderate	Low	Low	Moderate	Moderate	Moderate
- Universal application of EIAs	High	Moderate	Low	High	Low	High
- Increasing public participation	Moderate	Low	Low	High	Low	High
Analysis						
- Study of health effects of pollution	High	Low	Low	High	Low	High
- Economic evaluation of environmental damages	High	Low	Low	Moderate	Low	Low
Investment						
- National Environmental Information System	Moderate	Low	Low	Moderate	Low	Moderate

Table 26: Priorities for Policy Reform and Improved Management

Policy Management and Reform	Priority	Responsibility	Time Frame	Ref. Para.
A. Water Supply and Sewerage				
- Water and sewage tariff reform	High	ETOSS and provincial agencies	3 years	2.54
- Regulatory incentives for efficiency and privatization	High	Water agencies	5 years	2.64
- Low cost technologies for poor	High	SERNAH, ETOSS	3 year	2.36
B. Industrial Pollution Control				
- Clarification of environmental rules through Sectoral Action Plans	High	SERNAH,provinces	1 year	3.54
- Financial incentives for SMEs	Moderate	SERNAH	3 years	3.35
- Effluent fees for all discharges	High	SERNAH, AA	1 years	3.56
- Selection of a site for a hazardous waste facility though a compensation auction	High	SERNAH, PBA	1 year	3.57
C. Transport Pollution and Spatial Management				
- Emission standards enforcement	Moderate	Municipalities	1 year	4.37
- Pollution-adjusted fuel taxes	Moderate	National Governmt.	1 year	4.36
- Coordinating body for AMBA	Moderate	AMBA jurisds.	1 year	4.39
- Measures to reduce congestion and promote public transport	Moderate	AMBA jurisds.	1 year	4.38

D. Solid Waste Management				
- Solid waste collection fees	High	Municipalities	3 years	5.21(a)
- Technical guidance and financial incentives for municipalities	Moderate	SERNAH	3 years	5.21(b)
- Waste collection by neighborhood associations and NGOs	Moderate	Municipalities	3 years	5.21(c)
E. Institutional Framework				
- National Environmental Policy and Action Plan	Moderate	SERNAH	1 year	6.63
- Consolidation and decentralization of responsibilities	High	SERNAH, provinces	3 years	6.56
- Strengthening the legal systems	Moderate	SERNAH	2 years	6.61
- Universal application of EIAs	High	SERNAH, provinces	1 year	6.58
- Increasing public participation	High	SERNAH, provinces	1 year	6.62

Table 27: Priorities for Research, Information, and Analysis

Analysis and Studies	Priority	Responsibility	Time Frame	Para. No
A. Water and Sewerage				
- Least cost sewage treatment strategy for AMBA	Moderate	ETOSS, AA	2 years	2.57
- Groundwater study for AMBA	Moderate	ETOSS, AA	5 years	2.56
B. Industrial Pollution Control				
- Least cost industrial pollution control strategy for AMBA	Moderate	SERNAH, PBA, AA	1 year	3.58
C. Transport Pollution Management				
- Systematic monitoring of air quality	High	Municipalities	2 years	1.81(a)
- Master plan for public transport	Low	AMBA jurisd.	2 years	4.38(f)
- Land use planning for urban areas	Low	AMBA jurisd.	3 years	4.39(b)
D. Solid Waste Management				
- Economics of formal recycling	Low	Min. de Economía	2 years	0
E. Institutional Framework				
- Study of the health effects of pollution	High	SERNAH, Min. de Salud	2 years	1.81(b)
- Economic evaluation of environmental damages	Low	SERNAH, Univ.	3 years	1.81(c), 6.39

Table 28: Priorities for Investment

Investments	Priority	Responsibility	Time Frame	Para. No
A. Water and Sewerage				
- Supply and sewage collection	High	Water Cos.	15 yrs	2.54
- Sewage treatment in GBA	Low	Water Cos.	Not until studied	2.57
B. Industrial Pollution Control				
- Hazardous waste treatment/disposal facilities for AMBA	High	Private Operator	2 years	3.57
- Industrial pollution reduction through process changes at the time of investment or replacement of equipment	High	Industry	15 yrs	3.55
- Industrial pollution reduction through investment in end-of pipe treatment facilities	Moderate	Industry	5 years	3.54
C. Transport Pollution Management				
- Bus lanes, intermodal exchanges	Moderate	Municipalities Nat. Govt.	15 years	4.38
- Rehabilitation of subways and suburban raiways	Moderate		10 years	4.38
D. Solid Waste Management				
- Sanitary landfills in larger cities where they do not yet exist	High	Municipalities	10 yrs	5.21
E. Institutional Framework				
- National Environmental Information System	Moderate	SERNAH, Provinces	10 yrs	6.62

(c) Significant investments for the improvement of solid waste management and the construction of sanitary landfills are required in many urban areas. A project could combine financing with technical assistance toward the commercialization of solid waste management services.

(d) A project focussed on the rehabilitation of the existing surface and underground railway network in Gran Buenos Aires, plus its integration with bus transport, could make a significant contribution to the improvement of the environment through reducing congestion and the share of private vehicles.

(e) Several of the studies recommended in this report could be financed through a technical assistance loan, such as the Public Investment strengthening T.A. Project. This includes studies on service provision in low income neighborhoods, a systematic air quality monitoring program, and the economic evaluation of environmental damages.

(f) Several provinces could greatly benefit from technical assistance for environmental policy management. Such an initiative should be strictly complementary and closely coordinated with the IDB's Environmental Institutions Strengthening Project, working with SERNAH and a few selected provinces.

(g) Global concerns, such as climate change and ozone depletion, can be addressed through specific projects funded on a grant basis through the Bank-administered Global Environment Fund and Montreal Protocol Fund, respectively.

7.18 Future analytical work of the World Bank in support of the policy agenda could be provided in the following areas:

(a) The absence of metropolitan management in the Area Metropolitana de Buenos Aires is discussed as a major obstacle to more efficient provision of transport services, land use management, and pollution control. Bank sector work could make an important contribution drawing from the experience in metropolitan management around the world.

(b) Several of the identified problems are related to urban low-income neighborhoods (*villas miserias*): settlements in unsuitable and flood prone lands, lack of urban service provision, and the persistence of uncontrolled open air solid waste dumps. This problem complex could be addressed by a systematic analysis of policies to address the problems of people in these settlements.

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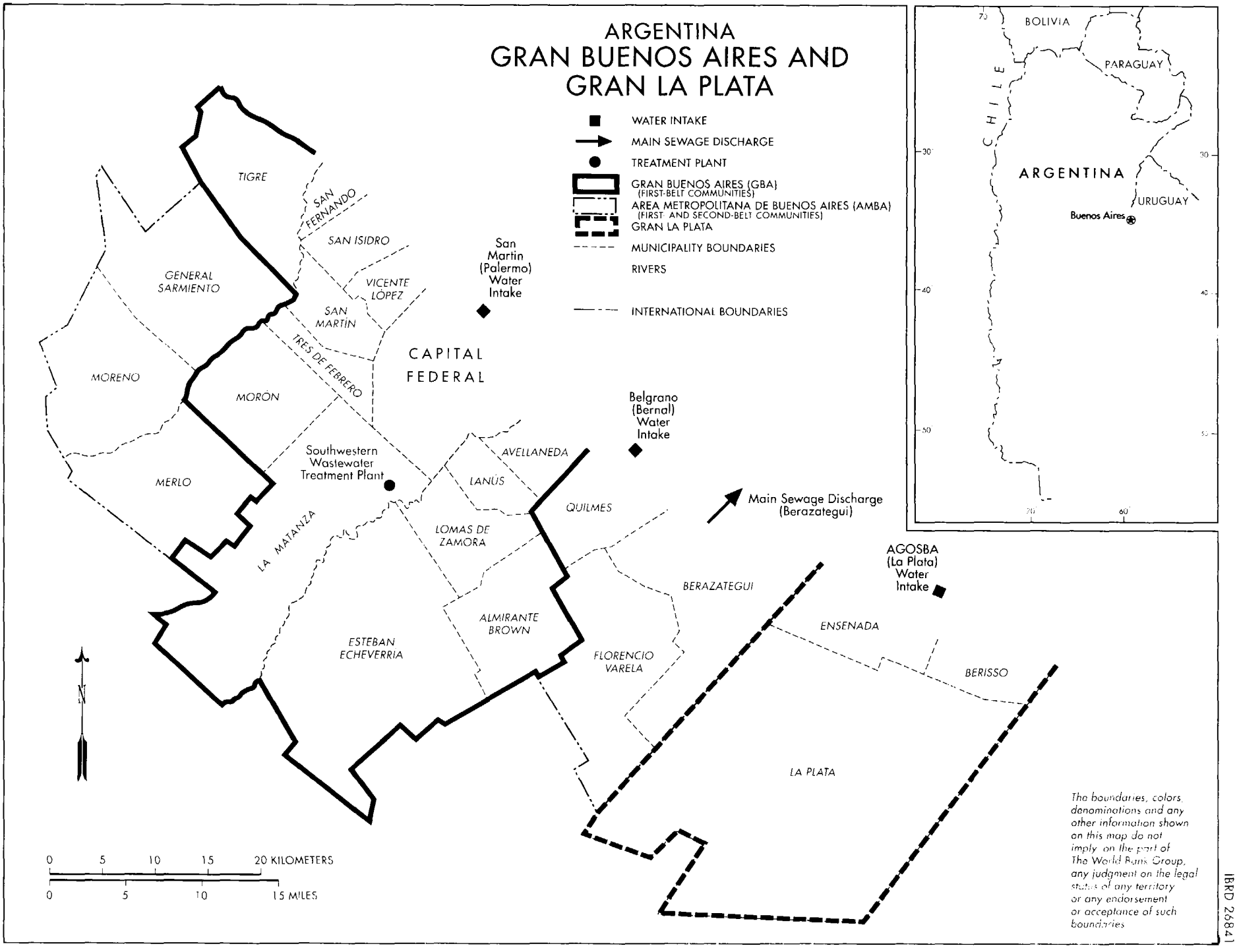

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