

Report No. 9623-CS

Czech and Slovak Federal Republic Joint Environmental Study

(In Two Volumes) Volume I—A joint report of the Governments of Czechoslovakia, the Czech and Slovak Republics, the European Community, the United States Government, and the World Bank

January 22, 1992

Technical Department
Environment Division
Europe, Middle East, and North Africa Region

MICROFICHE COPY

Report No. 9623-CS Type: (SEC)
WHITFORD, / X32505 / H-9045/ EMTEN

FOR OFFICIAL USE ONLY



Document of the World Bank

This document has a restricted distribution and may be used by recipients only in the performance of their official duties. Its contents may not otherwise be disclosed without World Bank authorization.

CURRENCY EQUIVALENTS

US\$ 1 = Koruny (Kcs) 29.51
(average January - August 1991)
Kcs 1.00 = US\$ 0.0358

WEIGHTS AND MEASURES

Metric System

ABBREVIATIONS AND ACRONYMS

AQMR - Air Quality Management Region
CAC - Command-and-control
CUPN - Czech Union for Protection of Nature
EA - Environmental assessment
EC - European Community
FCE - Federal Committee on Environment
FGD - Flue gas desulphurization
GDP - Gross Domestic Product
Kcs - Koruna
MBI - market-based instruments
NGO - Non-governmental Organization
NMP - Net Material Product
NOx - Nitrogen oxides
OECD - Organization for Economic Cooperation and
Development
PCB - Polychlorinated biphenyl
PHARE - Pologne-Hongrie Assistance à la
Reconstruction Economique (now extended to
other countries)
PIU - Programme Implementation Unit
PPP - Polluter pays principle
RPIU - Republic Programme Implementation Unit
SO₂ - Sulphur dioxide
UNSNA - United Nations System of National Accounts
UPP - User pays principle

FISCAL YEAR

January - December

CZECH AND SLOVAK FEDERAL REPUBLIC

JOINT ENVIRONMENTAL STUDY

Table of ContentsPage No.

VOLUME 1: MAIN REPORT

	FOREWORD	
	STUDY TEAM AND METHODOLOGY	i
	EXECUTIVE SUMMARY	iii
	INTRODUCTION: The Record of the Past	1
I.	GUIDING PRINCIPLES	3
II.	ENVIRONMENTAL PROBLEMS	
	A. Human Health Effects	8
	B. Ecological Effects	10
	C. Monitoring and Emissions	13
III.	PROPOSED RESPONSES	
	A. Economic and Sectoral Policy	17
	B. Institutional and Human Resources Development	25
	C. Mitigation Priorities	34
	D. Financing and Investments	40
IV.	PLAN OF ACTION	45
ANNEX	A. Risk Assessment	58

VOLUME 2: TECHNICAL REPORT

1.	Introduction	. . . . .
2.	Background	. . . . .
3	Environmental Policies and Attitudes	. . . . .
4.	Air Pollution	. . . . .
5.	Water Quality and Availability	. . . . .
6.	Soil Pollution and Degradation	. . . . .
7.	Hazardous and Toxic Wastes Problems	. . . . .
8.	Radiation Problems	. . . . .
9.	Agrochemical Problems	. . . . .
10.	Human Health Effects	. . . . .
11.	Landscape and Nature Conservation	. . . . .
12.	Environmental Planning Problems	. . . . .
13.	Transboundary Effects	. . . . .

ANNEXES

A. **Summaries of Consultants' Reports**

B. **Bibliography**

C. **Maps**

STUDY TEAM AND METHODOLOGY

i. The Joint Environmental Study (JES) arose from a request from the Government to the World Bank for assistance in compiling a study of Czechoslovakia's environmental problems, priorities and strategy. Subsequent discussion revealed that there could be considerable advantages in making this a joint study by the three governments - Federal, Czech and Slovak - and the principal potential donors in improving the Czechoslovak environment - the European Community (EC), the World Bank and the United States.

ii. A combined mission therefore took place in October-November 1990 during which available data was collected and analyzed, and policy and institutional needs extensively discussed. A Core Team representing the donors and including Mr. Vaclav Mezricky to represent the three governments assembled in Washington and drafted the JES report and its Plan of Action. This draft was extensively discussed with representatives of the three governments in February 1991 and the Plan of Action completed. With subsequent refinements, the present text now represents the considered views of the three governments and the participating donors.

iii. As expected, the JES process proved as valuable as the product. Many of the newer concepts, such as risk assessment, the use of market mechanisms, linkages with economic restructuring, decentralization, environmental auditing and environmental assessment were discussed at length, using formal seminars in some cases.

iv. The result is a document that is expected to have two major benefits: first, for the governments as a guide to shaping policies, legislation, institutions and environmental protection programs; and second, for the participating donors - as well as other donors contemplating assistance - in targeting their assistance to priority needs and avoiding duplication of effort. The JES has already been used by the participating donors to define their assistance strategies in environment for Czechoslovakia and to identify initial programs.

v. Below are listed the principal contributors to the JES. Others, too numerous to mention, also made valuable comments and suggestions. The International Relations departments of all three ministries made prodigious efforts to support the work of the JES. The authors wish to express their deep gratitude to the environmental ministers - Mr. Josef Vavrousek, Mr. Bedrich Moldan, then Mr. Ivan Dejmál, and Mr. Ivan Tirpák - not only for making the JES process possible and productive but also for their vision for an environmentally sound future and their considerable shaping of the study's conclusions.

STUDY TEAM

Federal Committee on
Environment

Bohuslav Moucha

Jan Mikolas

Czech Ministry of
Environment

Vaclav Mezricky

Svatomir Mlcoch

Zdenek Stary

Ludmila Hofmanova

Slovak Commission on
Environment

Kornelia Risova

Robert Brnak

World Bank

Peter W. Whitford

Hasan A. Tuluy

Mark Kosmo

Piotr Wilczynski*

Clyde Hertzman*

European Community

Philippe Bourel de la Roncière

UNITED STATES GOVERNMENT

Agency for International Development

Satish P. Shah

Ronald J. Greenberg

Samuel Hale*

James R. Newman*

Wesley K. Foell*

Richard A. Ellis*

Sharad S. Gandbhir*

Nicholas L. Rickard*

Environmental
Protection Agency

Dan Beardsley

Peter W. Preuss

Amy Evans

Richard Walentowicz

* Consultant

CZECHOSLOVAKIA

JOINT ENVIRONMENTAL STUDY

Executive Summary

i. Environmental degradation is one of the most serious problems facing Eastern Europe. The democratic revolution that recently swept the region revealed the consequences of forty years of industrialization without regard to worker health and safety, inefficient use of energy and raw materials, and the inability of the state to regulate itself. In each of the countries, better informed publics are demanding action to address air pollution that threatens their health and life expectancy, contaminated food and water supplies, and still unquantified hazards from toxic wastes, nuclear installations, and military activity. Nowhere is this better exemplified than in the Czech and Slovak Federal Republic.

ii. Czechoslovakia vies with its neighbors as one of the most polluted countries in the world. Air pollution is serious in all urban/industrial centers and, in Northern Bohemia, poses an immediate threat to human health, contributing to the death of much of the surrounding forest. Nearly 70% of the country's waterways are heavily polluted and the drinking water of many cities does not comply with international standards. Food contamination is not well documented but levels of heavy metals and persistent organic chemicals give serious cause for concern. Uncontrolled dumping of hazardous wastes poses serious, though not well quantified, threats to the population. A majority of animal species is considered endangered.

iii. These conditions arose not so much from deliberate policy choices - in fact, Czechoslovakia has long had strict environmental protection laws on its books - but were inherent in the command economy. Systematic underpricing of energy and raw materials led to usage per unit of output several times the levels in market economies and consequently high levels of pollution, exacerbated by the emphasis on heavy industry and reliance on indigenous fuels - largely low quality lignite in Czechoslovakia's case. Environmental agencies were virtually powerless to enforce the laws, as penalties were generally trivial, and programs to combat pollution were given low priority in the allocation of funds.

iv. Western countries, prior to about 1970, suffered from many of the same problems. However, recognition of their long-term impact led to massive programs for regulation and mitigation that have, in many cases, already shown dramatic results. The role that public pressure played in this process cannot be underestimated.

Basic Policy Directions

v. Just as the unwise economic policies of the past were the primary cause of today's environmental crisis, the new policies now being introduced can have a beneficial and immediate impact on pollution levels. The introduction of market forces will cause many obsolescent industries - often the worst polluters - to fail. Raised prices for energy and other raw

materials will encourage conservation and thus reduce consumption and the environmental consequences of power and mineral production. One estimate is that policies to reduce subsidies in these sectors alone will reduce SO₂ emissions by at least 25% by 1993. Reduction of state subsidies will also free budgetary resources for public goods such as the environment.

vi. However, the beneficial effects of economic restructuring will only be sustained and deepened if they are accompanied by the development of an integrated, decentralized environmental management system. An integrated system implies the simultaneous consideration of air, water and soil pollution problems in the setting of environmental priorities and management. Decentralization of decision-making will ensure the tailoring of environmental actions to the specific needs of each geographical area and avoidance of blanket applications. Public participation should be encouraged, both in setting and implementing policies.

vii. Ideally, environmental protection is most efficient when its costs are internalized through competitive market pricing of goods. However, there are considerable practical difficulties in estimating such costs and in internalizing them through taxes and charges. Like most other countries, Czechoslovakia will therefore need to maintain a balanced approach between market mechanisms and regulatory instruments (the "command and control" approach) during the period when the former are being developed and refined. The regulatory approach depends on credible enforcement, which in turn needs standards which are rational and compliance plans which are practical and reasonably phased. It also implies a need for an impartial adjudication system to resolve environmental disputes.

viii. Responsibility for environmental management rests mainly with the Republic level in Czechoslovakia. Regulation of air, water and soil pollution problems and the protection of natural ecosystems is the responsibility of the environmental agencies, agricultural practices with the agricultural ministries, food safety with the health ministries etc. This Study does not propose any change in this division of responsibility but does recognize the need for closer coordination between the various governmental agencies and levels of government. This is particularly true for the linkages between environment and the industry and energy sectors.

Present Status

ix. Attention is now directed at painting a more detailed picture of the nature of environmental threats in Czechoslovakia and their causality. It should be noted that, while statistics are relatively plentiful, careful studies to determine cause and effect are rather rare. The impact of pollution on life expectancy is a case in point; average nationwide life expectancy is 5 to 7 years less than in Western countries and even lower in the worst polluted regions. This strongly suggests a link, despite the absence of conclusive studies and the existence of other potential causative agents, such as smoking. Some measurements of heavy metals and chlorinated hydrocarbons in drinking water, food and human tissue would have led to health alerts had they occurred in Western Europe.

x. Ambient standards have been set for a few air pollutants and a wider range of water pollutants. As in Poland, ambient air standards are stricter than in most Western countries, compounding the problem of credible enforcement. Emission standards exist for some air pollutants, depending on the height of the stack, but exceptions are numerous and penalties light.

xi. Biodiversity in Czechoslovakia is seriously threatened, not only by pollution but also by inappropriate agricultural, drainage and "land reclamation" programs. Air pollution is considered to be the primary cause of the loss of about one-third of the country's forests. Pollution and overuse by visitors is degrading national parks and preserves. Strip mining has disturbed large areas and reclamation efforts to date are inadequate.

xii. Sources of air pollution are fairly well documented and consist mainly of thermal power stations, mines and major manufacturing industries. In the cities, home heating and motor vehicles are additional sources. Water pollution sources are more diffused but towns and industries are the major point sources and agriculture the major non-point source. Some 2,500 towns discharge untreated sewage into rivers while, for most of the rest, treatment is only partial. Czechoslovakia is a net exporter of both air and water pollution.

xiii. Monitoring is generally adequate for a limited range of pollutants, such as SO₂, NO_x and particulates (air), biochemical oxygen demand (BOD), chemical oxygen demand (COD) and total suspended solids (water). Groundwater and soil monitoring is very limited. Food contamination is relatively well monitored though little analysis has yet been done. For human health, extensive data is available but rigorous analyses are also few. The use of exposure assessment and risk analysis in Czechoslovakia is not yet widely practiced though there is considerable interest in their use. There is also a need to focus environmental research on a more clearly defined framework related to national priorities.

Towards a Plan of Action

xiv. Recognizing that pollution control programs in the absence of sound policies and strong laws and institutions will likely be ineffective, Czechoslovakia's strategy to address the above environmental problems can be divided into three areas: economic and sectoral policy; institutional and human resources development; and, mitigation priorities and programs. In July, 1990, a State Ecological Policy was put forward to initiate a plan to address Czechoslovakia's environmental problems. The State Program for Environmental Protection was approved by the Federal and Republic Governments in April 1991, and is intended to identify priority measures and objectives for protecting the environment in Czechoslovakia. It addresses such issues as environmental policy and management, environmental investment, environmental training and education, and strategies for addressing regional and international environmental problems. The state program is an open document which will be regularly supplemented and refined as additional knowledge and information becomes available. For example, the next version due out in 1992 will reflect the findings and recommendations of the Joint Environmental Study.

Economic and Sectoral Policy

xv. As noted above, the current macro-economic reform program is expected to provide major environmental benefits. Czechoslovakia already has a rather elaborate system of pollution charges, user fees and fines, for both water and air (para 61-65). However, charges are invariably well below the level needed to induce change towards less polluting behavior, user fees are a small fraction of the costs of providing water, sewerage and solid waste services, and fines are rarely applied and have little deterrent effect. The course ahead is clear: the mechanisms for calculating charges equivalent to the cost of pollution control need to be refined and expanded to cover a wider range of pollutants; charges need to be raised as soon as practicable to approach those levels; in the long term, user fees should be raised to cover full economic costs; and fines (and possibly criminal penalties) raised and enforced. The Study recommends that charges and fees be raised in several stages, an initial substantial increase immediately to raise revenue and to signal the intent of the Governments to move to a market based system, and subsequent increases after new legislation and formulae are in place, beginning in about two years' time. Revenues from charges and fines will be placed in Environmental Funds at the Republic level and used on a loan or subsidy basis for environmental projects in the municipal or enterprise sectors.

xvi. The role of environmental taxes is also being actively explored. These taxes would incorporate the cost of environmental clean-up into the final price of commodities, such as coal and hazardous materials, in order to reflect the environmental consequences of their use. Such taxes will also encourage the use of cleaner substitutes.

Institutional and Human Resources Development

xvii. The Year 1990 saw the formation of a Federal Committee on Environment (FCE), a Czech Ministry of Environment (CME) and a Slovak Commission on Environment (SCE). The FCE is a relatively small body concerned with international affairs, aid coordination, setting overall policy, laws and standards, and coordinating environmental policy at the Federal level. The CME and SCE differ slightly but have similar responsibilities in the formulation and implementation of environmental policy and programs. The role of local governments has not yet been fully worked out but logic suggests that they be responsible for urban planning, supervision of water and sewerage enterprises, operation of solid waste disposal systems and local monitoring.

xviii. There remains a set of problems that lend themselves to regional solutions and the Republics intend to experiment with strengthening the role of the existing River Basin Boards in water quality and establishing one or more Air Quality Management Regions. For the longer term, bodies able to manage on an integrated basis (para vi) should be established.

xix. Several pieces of environmental legislation are under preparation, including a new umbrella environmental law and laws on air and water quality and solid waste. These laws will be followed by regulations on ambient and emission standards which will be defined at the republic level and generally consistent with EC practice. Laws on water and hazardous wastes have already

been passed, but some laws are being held up by a lack of a clear definition of responsibility at the Federal level; this needs to be resolved soon, in order to ensure that economic restructuring takes place on a sound environmental basis. The adoption of EC standards for emissions and effluents needs to be phased in at a rate consistent with the economic recovery process, with interim standards to be met reasonably soon. The CME and SCE need to strengthen their inspection and enforcement systems, inter alia, by training of inspectors and the introduction of administrative law judges.

xx. Czechoslovakia's various environmental monitoring systems need to be integrated into a comprehensive environmental information system, starting with an assessment of the needs of various users, development of a least-cost strategy for data collection and analysis and initiation of publications of various kinds. The system should permit better public access to information.

xxi. The Federal and Republic environmental agencies should strengthen their linkages with the economic restructuring process through the appointment of senior advisers with special responsibility for coordination with the industry and energy sectors initially, with transport and agriculture as the next priority. This will better ensure that environmental issues are adequately addressed as a component of sectoral reform.

xxii. A cautious approach to industrial pollution control is recommended, in light of the still uncertain impact of economic reform. Polluting industries should first be assessed as to their long-term economic viability, in order that assistance for pollution control can be targeted towards plants which will continue operating under the government's privatization plans. Those which are potentially viable should first carry out an environmental audit to identify low cost means of reducing waste and pollution; dramatic results can often be achieved with improved management and maintenance. Only then should major investments in new technology or treatment plants be considered. Both Republics recognize the need to introduce as quickly as possible improved procedures for environment assessment of all new project proposals in the public and private sectors with provision for public participation. An environmental "code of conduct" for both public and private industry should also be promulgated as part of the privatization process. Such a code would clarify responsibility for remedying past environmental neglect, as well as setting clear guidelines for compliance with environmental standards.

xxiii. Non-government organizations have a crucial role to play both in advocating changes in environmental policy and in carrying out appropriate environmental programs, such as public education. If the government does not take an active role in environmental education, some government support for the latter function may be appropriate.

xxiv. While the environmental agencies are generally well-staffed with technical specialists, they often lack skills in market economics and financial planning. Managers need additional training in environmental management in order to make full use of a diverse staff, perhaps through a Masters degree program at a leading university. The agencies need to formulate staff development plans.

xxv. The FCE recently established a Programme Implementation Unit (PIU) to coordinate the first program of assistance from the EC. In principle, the PIU will coordinate all foreign assistance in environment and it is developing registers of projects, consultants, and equipment suppliers. This leaves some important aid coordination roles to be performed at the Republic level, as this will be the locus for most investment programs. For this reason, Republic PIUs (RPIUs) will be established, with particular responsibility for project implementation, procurement and reporting to donors, in close coordination with the PIU.

Investment Needs

xxvi. The gradual adoption of the "polluter pays" principle, together with the privatization of industry, will eventually pass on the cost of environmental protection to the consumer through the price of goods and services. Remediation of past pollution will continue to be largely borne by the public sector, either through direct budgetary support or from environmental funds (para xv). Environmental investment historically in Czechoslovakia has been less than 1% of national income. However, in the absence of sound policies and assessments of relative risks, these investments were not particularly effective. Investment levels now need to be doubled.

xxvii. The total investment needed to achieve acceptable environmental standards has been estimated at more than \$50 billion. Current expenditures, essentially all in the public sector at present, total about \$400 million per year. Even if the recommended increases in charges, fees and fines (para xv) and new taxes result in a doubling or tripling of resources available to environmental programs, it will still be several decades before an environment acceptable to the Czechoslovak people is achieved. External public and private sector funding, especially through government incentives to private investment, could shorten this time span, as well as facilitate access to Western technology. While borrowing for environmental protection at a time of great economic uncertainty may seem risky, terms should be sought which shift the repayment burden to the medium term when the country should be on a strong growth path. Failure to institute sound environmental programs will not only add to the health burden already carried by Czechoslovakia's people but would be a strong deterrent to the environmentally responsible investment that the country needs to attract.

Mitigation Priorities and Programs

xxviii. Available data on toxicity, exposure, population and reversibility have been assessed in a qualitative fashion to determine a rough ranking order for environmental threats to human health. This analysis indicates that air pollution and food contamination are the highest priority problems, followed by water and solid waste issues. Research to quantify relative risks is urgently needed. Although an integrated (multi-media) approach reinforced by market incentives will be needed to address these areas, the Study recognizes that this will not be possible for some time and the following description of specific mitigation programs follows the conventional single-medium approach.

xxix. For air pollution, immediate efforts should focus on SO₂ and particulates, recognizing that the latter can be controlled at lower cost. Such programs should give priority to "black spots" such as Northern Bohemia and emphasize the reduction of peak ambient values. Next should come attention to the problems of the large cities, particularly by reducing the use of dirty fuels for home heating (usually by expanding the provision of natural gas) and tackling vehicle emissions. More study is needed for air pollutants such as heavy metals and organics in order to develop cost-effective control strategies.

xxx. For food contamination, the most urgent need is for studies to establish relative risks, especially for vulnerable population groups, and to trace the pathways by which contaminants enter the food chain, in order to develop control strategies.

xxxi. While priority in water pollution control should probably go to the reduction of toxic pollutants from industry, the step-by-step approach of para xxii is needed now, rather than massive investments. The large ongoing program of municipal waste water treatment should continue, with emphasis on accelerating the completion of ongoing projects. A water quality management plan should be completed for each river basin, including groundwater resources.

xxxii. For hazardous wastes, a priority need is to complete inventories on current production and to pass laws and regulations on safe storage, transport and disposal of such wastes. Following programs to minimize production of wastes, facilities such as fixed and mobile incinerators will be needed, operating as far as possible on a commercial basis. Abandoned dumps are generally of lower priority, unless they pose a clear danger to human health and safety. In such cases, the first step should be to prepare emergency response and evacuation plans. A long-term program for disposal of nuclear wastes is needed.

xxxiii. Nature conservation policies should be based on scientific assessments of endangered species and habitats, such as wetlands. Policies for protected areas need to be more carefully balanced between scientific, recreational and commercial objectives. Revision of agricultural and forestry policies could also have considerable conservation benefits.

Plan of Action

xxxiv. Chapter 4 of the report sets out the recommended short-term priority actions of the Study in matrix form. These are divided into actions which are needed immediately, within one year and within three years. A summary of these recommendations is presented in two matrices below -- one for overall environmental policy and one for specific environmental issues.

Plan of Action
Environmental Policy Matrix

Priority of Action

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
<u>Macro-Economic Policy</u>				
General	CSEFR, CR & SR	Begin phaseout of subsidies on energy, water, raw materials and agricultural inputs and subsidies to resource-consuming enterprises.	Continue phaseout. Institute privatization program for large enterprises.	Complete phaseout of subsidies.
<u>Sectoral Coordination</u>				
General	FCE	Ensure environmental concerns recognized in design of new sector policies.	Review scope for taxation measures with fiscal and incentive benefits (e.g., coal or hydrocarbon taxes, differential product charges).	
<u>Environmental Audits</u>				
Environmental Audits	CR & SR	Develop list of major polluters. Begin pilot program of industrial environmental audits, including training, in consultation with target sectors.	Generalize program of industrial environmental audits. Provide TA and training to develop private sector companies to conduct audits.	Develop training curriculum for environmental audits.
<u>Inter-sectoral linkages</u>				
Inter-sectoral linkages	FCE, CME & SCE	Appointment of high-level liaison staff plus adviser on environment-energy linkages. Appointment of high-level liaison staff plus adviser on environment-industry linkages.	Strengthen links to other sectors such as agriculture, labor (occupational safety and health) and transportation. Identify and design projects to demonstrate innovative approaches and technologies.	Implement demonstration projects.
<u>Institutional Roles</u>				
General	FCE, CME & SCE	Clearly specify Federal and Republic environmental responsibilities.	Establish unit in each ministry to identify research needs and to translate research findings (for example, on risk assessment) into policy and program recommendations.	Establish Environmental Policy Institute, if justified.
	FCE, CME & SCE	Establish environmental economics policy analysis in each Ministry (part of PIU and RPIU)	Initiate studies jointly with other Ministries to assess environmental and natural resources impact of macro and sectoral policies and to recommend new policy approaches.	Continue studies and implement findings.

Priority of Action

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
Local Government	CME & SCE CR & SR	Policy statement on role of local government.	Managerial strengthening of water, sewerage and solid waste organizations in selected cities, including financial planning.	Expand the establishment of municipal environmental units and locally-managed utilities.
Air Quality Management Regions (AQMRs)	CME & SCE	Legislation on AQMRs (part of Air Quality Law).	Establishment of AQMR in Northern Bohemia.	Establishment of additional AQMRs.
River Basin Boards	CME & SCE	Legislation on river basin boards (part of Water Quality Law).	Restructuring of first river basin board (Hornad).	Restructuring of other river basin boards.
Public Participation	FCE, CME & SCE	Review issues of public participation in developing policy, setting fees or standards, enforcement, and monitoring and evaluation.	Design and initiate appropriate public participation programs. Establish policy on public access to environmental information.	Build formal public participation processes into policy and standards development processes. Incorporate eco-parliament or other public participation models in design and test of regional environmental management entities.
Environmental Assessment	CME & SCE	Establish EA regulations.	Establish organizational units to monitor EA process.	
<u>Legislation and Enforcement</u>				
Legislation	FCE, CME & SCE	Pass the new Environmental Law, involving provision for revised air, water and soil standards and revised pollution charges and penalties.	Pass new laws on air pollution, water pollution, hazardous waste and nature conservation.	
Enforcement	FCE, CME & SCE	Initiate preparatory work, including training and education programs, for improved standards-setting, permitting and enforcement.	For main emitters: develop interim air and water emission ceilings and compliance schedules, effective permitting systems, and fee and fine structures.	For main emitters: full enforcement of applicable standards. For other emitters: implement interim air and water emission ceilings, effective permitting systems, and fee and fine structures.

Priority of Action

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
<u>Role of the Private Sector</u>	CME & SCE	Adopt an Environmental Code of Conduct for all large privatizations.	Monitor implementation of Code of Conduct.	
	FCE, CME & SCE	Identify/assess opportunities for private provision of environmental services, including policy analysis and advice, as well as technical areas.	For priority areas, assess/select institutional options (competition, government contract or franchise, regulated public utility, etc.).	Fully functioning private sector operations in priority areas.
<u>International relations</u>				
PIU	FCE	Establish federal PIU with appropriate staff and foreign advisers.	Expand role of PIU to accommodate needs of other donors and to assume aid coordination role.	
RPIU	CME & SCE	Establish RPIUs in both Republics.	Strengthen RPIUs.	
<u>Trans-Boundary Issues</u>	FCE	Develop program for complying with trans-boundary agreements.	Ratify outstanding international agreements.	
	FCE & CME	Appoint working group to foster regional cooperation on transboundary air pollution, in particular with Poland and Germany.	Develop a cooperative plan of action.	Implement plan of action.
	FCE, CME & SCE	Appoint working groups to foster regional cooperation on transboundary water pollution, especially for the Labe (Elbe), Odra and Danube Basins.	Develop cooperative plans of action for one or two key basins.	Implement plans of action. Develop plans for other basins.

Priority of Action

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
<p><u>Financing Instruments</u></p> <p>Pollution and User Charges</p>	<p>CME & SCE</p>	<p>Increase air and water pollution charges and fines immediately following adoption of enabling and implementation legislation, and ensure such charges and fines are indexed to an industrial price index.</p> <p>Introduce waste charges indexed to an industrial price index upon adoption of enabling legislation.</p>	<p>Phase-in real increases in air and water pollution charges, in line with the analysis of MAC.</p> <p>Begin applying system of royalties or other payments for natural resource extraction (e.g., minerals or forest products).</p> <p>Phase-in real increases in user fees for water supply, wastewater treatment, and solid and hazardous waste collection and disposal to progressively cover full costs of such services.</p>	<p>By end of period (3-5 years), achieve levels of (a) pollution charges where waste generators would prefer to prevent pollution rather than pay charges, (b) royalties which fully reflect environmental and other social costs of natural resource use, and (c) user fees which reflect long-run marginal costs of the services.</p> <p>Achieve self-management and self-financing at local level for a majority of water supply, sewerage and municipal solid waste systems.</p>
<p>Strategy</p>	<p>CSFR, CME & SCE</p>	<p>Review and strengthen framework for the collection and use of pollution and user charges.</p> <p>Identify (on a least cost basis) priority financing needs and current or potential sources of such financing including waste generators, environmental service firms, pollution charges as they are increased, etc.</p> <p>Establish Republic Environmental Funds.</p> <p>Earmark revenues from pollution charges and fines to environmental expenditures.</p>	<p>Permit pilot River Basin Boards and AQMRs to: (i) retain revenues from pollution charges and fines; and (ii) set standards, charges and fines stricter than Republic minima.</p> <p>Establish time-phased priorities for Republic Environmental Fund expenditures.</p> <p>Assess opportunities for further decentralization of collection and expenditure of fees and charges.</p> <p>Introduce a tax on toxic wastes and production processes generating toxic wastes.</p>	<p>Within two years, start phaseout of general budgetary financing of environmental investments, with increasing reliance on the polluter and user pays principles.</p>

Plan of Action
Environmental Issues Matrix

Priority of Action

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
<p><u>Mitigation Measures</u></p> <p>Air Pollution</p>	<p>CSFR, CR & SR</p>	<p>Determine priorities for FGD.</p> <p>Undertake feasibility and design studies for priority FGD sites (Prunerov, Tusimice, etc.)</p> <p>Develop action plan for particulate control, followed by design studies.</p> <p>Upgrade pollution emergency plans, using a broader range of instruments.</p> <p>Inventory other major air pollution sources.</p>	<p>Implement FGD and ESP investments at priority sites.</p> <p>Analyze nature and extent of motor vehicle contribution to air pollution and develop control strategy.</p> <p>Implement improved emergency planning in one region (e.g. Northern Bohemia).</p> <p>Develop least-cost investment plans for public sector sources and compliance plans for private sector.</p>	<p>Continue investment program.</p> <p>Implement motor vehicle air quality strategy.</p> <p>Extend planning to additional regions.</p> <p>Implement plans and monitor compliance.</p>
<p>Food Contamination</p>	<p>CSFR, CR & SR</p>	<p>Develop short-term monitoring and analytical program to assess risks and trace pathways.</p>	<p>Develop strategy for reducing food contamination to acceptable levels and commence implementation.</p>	<p>Continue implementation and monitoring.</p>
<p>Water Pollution</p>	<p>CR & SR</p>	<p>Accelerate completion of ongoing municipal waste water treatment plants, with pre-treatment of industrial wastes.</p> <p>Review priorities for industrial waste water treatment based on relative risks, economic viability of enterprise and self-financing capability.</p>	<p>Develop program of new municipal waste water treatment projects based on relative risks, institutional capability and self-financing capability.</p> <p>Undertake study of potential for private sector management or ownership of water and sewerage systems.</p> <p>Continue support to industrial pollution control through lines of credit.</p> <p>Draw up first river basin water quality management plan, including non-point sources and groundwater issues.</p>	<p>Continue implementation.</p> <p>Develop demonstration cases for privatization.</p> <p>Continue implementation.</p> <p>Prepare additional river basin water quality management plans.</p>

Priority of Action

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
Wastes - Hazardous	FCE, CME & SCE	<p>Upgrade inventories of current production of toxic and hazardous wastes and past dump sites, including screening for relative risks.</p> <p>Determine role of private sector in hazardous waste disposal.</p> <p>Prepare emergency response and evacuation plans for extremely hazardous sites.</p>	<p>Issue regulations on storage, transport and disposal of hazardous wastes.</p> <p>Institute hazardous waste information system.</p> <p>Specify and procure demonstration mobile hazardous waste disposal facility.</p> <p>Design and begin construction of first central disposal facilities.</p>	<p>Begin major effort to address past dumpsites.</p> <p>Develop long-term plan for safe disposal of nuclear wastes.</p>
Wastes - Nuclear		<p>Improve radiological monitoring, safety management, and emergency planning.</p>	<p>Develop long-term program for storage and disposal of spent fuel.</p>	
Wastes - Municipal	CME & SCE	<p>Identify opportunities in at least three major urban centers for a comprehensive approach to solid waste collection and disposal, including recycling.</p>	<p>Develop project plans for three cities.</p> <p>Begin one demonstration scheme for innovative solid waste management.</p> <p>Assess potential private sector role in waste management.</p>	<p>Develop plans for additional cities.</p> <p>Implement initial set of comprehensive plans.</p> <p>Privatize waste services in selected locations.</p>
Nature Conservation	FCE, CME & SCE	<p>Develop a nature conservation policy which balances scientific, developmental and recreational objectives. Develop specific policies for endangered flora, fauna and habitats.</p>	<p>Revise listings of threatened and endangered species to include only native species truly threatened.</p> <p>Incorporate impacts on threatened species in EA procedures.</p>	<p>Consolidate responsibility at the Republic level for nature conservation under a single organization.</p>
Protected Areas	CME & SCE		<p>Review size, location and status of all protected areas, including border areas, assess threats to them from pollution and unmanaged development and develop a protected areas strategy.</p> <p>Install system for monitoring ecological status and trends for the protected areas system.</p>	<p>Implement strategy, including managerial strengthening and tapping of revenue potential.</p> <p>Implement "integrated landscape studies" for Krivoklat, Trebon, Krknose, Palava and Jeseniky.</p>
Aquatic Resources	CME & SCE	<p>Develop coordinated Federal/ Republic policies for rivers, lakes and wetlands, including a "no net loss" policy for wetlands.</p>	<p>Review adequacy of proposed new water quality standards from aquatic resources viewpoint.</p>	

Priority of Action

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
Forestry	CR & SR	<p>Review forest management and reforestation policies to emphasize conservation of original forest species and soil and water conservation and propose amendments to the Forestry Act.</p> <p>Establish a joint Federal/ Republic committee to harmonize policies and to deal with transboundary issues.</p>	<p>Review adequacy of proposed new air quality standards from forest management standpoint.</p> <p>Implement improved forest management practices, emphasizing no cost/ low cost measures.</p> <p>Introduce measures to promote privatization of forest resources under strict environmental controls and with realistic royalty payments.</p>	<p>Monitor results of improved forest management and air pollution reductions.</p>
Agriculture	CR & SR	<p>Incorporate environmental concerns in revised Agriculture Law, with emphasis on groundwater, surface water, biodiversity and endangered species.</p> <p>Develop policy on soil conservation.</p> <p>Develop training programs for newly privatized landowners, including environmentally friendly farming techniques.</p>	<p>Revise pesticide regulations to reflect impacts on flora and fauna, water quality and operator safety.</p> <p>Introduce regulations on fertilizer use and intensive animal production in line with Western European practice.</p> <p>Introduce a credit program for farmers needing financial assistance in meeting new standards.</p>	<p>Monitor impact of new regulations on water quality and biodiversity.</p>
Land Reclamation	CR & SR	<p>Discontinue programs for reclaiming marginal lands, especially wetlands, to compensate for land lost to urbanization.</p> <p>Undertake study for reclamation of mined lands in Northern Bohemia, emphasizing policy development, legal responsibilities and financing mechanisms.</p>	<p>Draft new legislation for land reclamation.</p> <p>Implement program of improved reclamation in Northern Bohemia.</p> <p>Undertake studies of other mining areas.</p>	

INTRODUCTION; The Record of the Past

The cost of past policies

1. Czechoslovakia's economic growth from the Second World War through the early 1980s was less than that of the OECD countries, but it still took place at the expense of severe degradation of its natural resources and environment. The cost to the economy of this environmental degradation has been estimated at 5-7 percent of national income in the 1980s¹, reflecting, in particular, rising health problems and the concomitant loss in labor productivity, and losses in agricultural and forestry production.

2. The extensive use of low-quality brown coal (lignite) contributes to a level of air pollution which is among the highest in the world. Air pollution from domestic and foreign sources has also led to increasing destruction of forests, with some estimates suggesting that as much as one-third of forests may have already been lost or irreversibly damaged. Land productivity is being impaired by erosion, soil compaction, and waterlogging from ill-suited agricultural practices. Nearly 70 percent of the country's waterways are heavily polluted, with about 30 percent of the major rivers classified as being incapable of sustaining most kinds of fish. In addition, there are water shortages because of the contamination of surface and ground water sources. Other forms of pollution, including municipal solid wastes, and hazardous and toxic wastes from industry, are widespread, though their sources and extent have yet to be fully assessed. With nearly one-third of the population exposed to high levels of air and water pollution, environmental degradation is a significant cause of human health problems in the hot spot regions of Czechoslovakia. While human health data are incomplete and a monitoring system for long-term health problems is not available, it has been suggested that pollution results in lower life expectancy and higher morbidity rates. The deterioration of health conditions linked to air pollution is evident in the increased rate of occupational disability of the inhabitants of the most polluted areas. Health problems associated with ground water contamination are a growing problem, as large numbers of the rural population rely on well water (paras 20-23).

The underlying causes of environmental degradation

3. The degradation of Czechoslovakia's environment can be ascribed in large part to inefficiencies attributed to the absence of market forces under the centrally planned economic policy framework existing until late-1989. Central allocation of resources coupled with physical performance targets, and an administered pricing policy, together with soft budget policies which placed no

¹ The concept of National Income used here is the Net Material Product (NMP). Czechoslovakia's NMP has been estimated at between 20 and 25 percent less than GDP calculated using the United Nations System of National Accounts (UNSNA). Source of the estimate is the Czech Union for the Protection of Nature, Stav a Vyvoj Zivotniho Prostredi v Ceskoslovensku, Cesky Svaz Ochrancu Prirody, Ceske Budejovice, Prague, Czechoslovakia: 1989.

value on scarce natural resources, resulted in an intensity of energy, material resources and water use that was very high by international standards. In addition, these policies promoted an economic structure biased towards heavy industries and the energy sector which accounted for approximately 60% of total output throughout the 1980s. The prevailing technologies, often out-of-date and inappropriate, promoted excessive use of energy and raw materials and produced high volumes of waste products. Indeed, energy consumption per unit of output in Czechoslovakia is about 3-5 times average levels in OECD countries. Below cost pricing of natural resources and of services provided by public utilities, and extensive recourse to subsidies created a bias against investments in pollution abatement, adequate maintenance of existing plant, and higher levels of recycling. Pollution charges--fees and fines--are well below abatement costs and, in practice, when accompanied by the soft budget policies, had no impact on polluters' behavior. Furthermore, the State monopoly on production in many industries, especially heavy industries, precluded any positive role for economic and non-economic instruments for environment protection that might alter such behavior.

Comparison with the Western Economic and Political Situation

4. In the period between the end of the Second World War and 1970, Western democratic economies showed many of the same problems as those just described. These included: investment in heavy industry; extensive use of coal as an energy source, with concomitant air pollution; careless farming practices such as overuse of fertilizers; dumping of garbage and sewage into surface water bodies; insensitivity to air pollution associated with motor vehicle emissions; and so forth. Indeed, many environmental problems related to these pollution sources remain. During the past twenty years, however, all Western countries have begun massive efforts to address these pollution issues. Their relative success in doing so might be traced to three factors: first, a significant proportion of the public has, for widely varying reasons, come to value environmental integrity. In democratic systems, public interest groups have become a powerful and effective lobby for environmental improvements. Second, competitive pricing of natural resources has driven energy producers in Western systems to find methods for conserving water, coal, and other (often substitute) resources. Third, the efficiency of market systems has produced the capital necessary to invest in infrastructure improvements (i.e., sewage treatment facilities) and to permit installation of pollution control equipment (i.e., scrubbers and precipitators) in manufacturing operations.

* * *

5. The first chapter of this report provides an overview of the guiding principles of a sound environmental policy and management system to address pollution abatement and remediation problems in Czechoslovakia. This chapter is then followed by a discussion of the key environmental problems, human health and ecological, the country faces. It also presents a framework for an effective monitoring strategy and for setting research priorities. The following chapter suggests a range of responses to remedy these environmental problems. These include measures in the areas of economic and sectoral policies, institution building and strengthening, priorities in direct mitigation, and the financing mechanisms for such responses. The fourth chapter lays out a phased, three-year Plan of Action for the adoption of the essential measures. Finally, Volume 2 of the report assembles the more detailed technical data on which the main volume of the report extensively draws.

CHAPTER I

Guiding Principles

1. The focus of this chapter is on the fundamental building blocks for an environmental policy and management system to address pollution problems and other environmental priorities in Czechoslovakia. This approach assumes that protection and preservation goals can only be achieved over the long term and, for that reason, a stable and enduring system must be established. This approach also assumes that environmental protection must be balanced with economic development objectives as carefully as possible, and that environmental goals must be achieved at the lowest practicable cost.
2. Because past policies were a major cause of current environmental degradation, changes in economic policies and management currently underway will, if continued, have a major beneficial impact on the environment. Free market or fully cost-based pricing will eliminate incentives to overuse energy and other resources, reducing degradation associated with such overuse. Forcing producers to compete in open markets will likely lead to a restructuring away from heavy industry, for example, and toward generally less polluting lighter industry and services. It will also force all producers to become more efficient, which will reduce resource waste and associated environmental effects.
3. Many of the most serious pollution sources in Czechoslovakia are in heavy industry, which is using antiquated technology that will not be competitive in a free-market economy. Previous production targets have not been based on market demand, and most heavy industry products contained embedded energy and raw material, as well as general budget, subsidies. The most significant near-term environmental benefits are likely to be gained through market-induced restructuring away from older, inefficient or unneeded industrial sources and their replacement with less polluting processes under conditions of competitive private enterprise. The first principle for sound environmental management, in other words, should be a sensible industrial policy during this transitional phase fully consistent with environmental policy goals. A second significant source of environmental benefits in industry can be improved operation and maintenance ("housekeeping") which typically both reduces environmental degradation and improves competitiveness of the enterprise.
4. Similarly, policies established in other commercial and governmental sectors will have more near-term influence on environmental quality than activities directly related to environmental standard-setting and enforcement. Three sectors deserve particular attention. Energy technologies must be made more efficient and less polluting; energy users must be encouraged to switch to cleaner fuels (including clean coal); and energy conservation should become a major governmental priority. Second, use of agricultural chemicals banned in Western countries, overuse of pesticides and fertilizers, and other careless agricultural practices result in serious contamination of Czechoslovakia's surface and ground waters and food supplies. Third, auto, truck, and bus emissions are directly correlated with serious human health effects, particularly in large urban areas. Hence transportation policy--ranging from commitment to mass transportation systems to fuel taxing--will have major implications for

environmental quality. In all three cases, pricing policies and promotion of economic competition, within a framework of strictly enforced realistic standards, constitute major means of accomplishing these sectoral objectives.

5. A dilemma in environmental policy for all nations is striking the balance between the need for equity and the desire for efficiency. Czechoslovakia has allocated to the Federal level a set of coordination, information, and international responsibilities, including establishing basic legislation. The remaining question is the extent to which laws and standards will be established at the Republic vs. community level. Environmental equity is important from an environmental management perspective--to ensure some level of equal protection to all people, to prevent creation of "pollution havens", and so forth. But equity is also crucial for commerce since ill-conceived environmental resolutions can make product development immeasurably more difficult and costly. On the other hand, pollution control is more efficient the closer it occurs to the pollution source, because the seriousness of a threat generally depends on assessment of local health and ecological exposures.

6. The Czech and Slovak Republics should consider promulgation of similar basic environmental laws and standards, therefore, to address pollution problems that have potential interjurisdictional or transboundary effects or which are necessary to encourage reasonable predictability and development of commerce. In general, this might include establishing minimum standards for: toxic air pollutants and those which contribute to acid rain and ozone depletion; basic emissions into surface water bodies; major potential contaminants of groundwater; and standards regarding new chemicals, agricultural chemicals, and food, worker, and product safety. Local communities should be encouraged to develop more stringent standards in these areas based on local exposure conditions. Certain other environmental protection responsibilities, such as protection of drinking water, solid waste management, and land use planning for protection of ecological and natural resource values, might be left wholly to community authorities.

7. From an economic point of view, environmental protection is most efficient when its costs are internalized through competitive market pricing of goods. It is thus attractive policy to cost out pollution control and clean-up associated with product development, then establish mechanisms for ensuring that those costs are included in the market price of industrial and commercial actions. An important first step in this approach is to identify and correct subsidies, non-competitive markets, or other policies which distort the relationship between market prices and environmental costs. While this should be done whenever possible, it often involves complicated analysis and market prediction.

8. A more practical short-term approach for Czechoslovakia would rely on a balance between "command-and-control" methods and use of market mechanisms. "Command-and-control" involves creation of the traditional system of standards, permits, and legal enforcement, with civil fines and criminal penalties for non-compliance. Credible enforcement of environmental law is the bedrock of every environmental management system. Developing a strong enforcement system may be particularly critical for Czechoslovakia (and other Central/Eastern European nations) given the history of the past 45 years, during which there was such a large discrepancy between strong laws and highly ineffective implementation.

9. A credible enforcement system begins with the approach to law-making and regulation itself: compliance must be practically achievable by the regulated parties. It will not be merely impractical for Czechoslovakia to adopt Western European or American standards whole cloth. To the extent these standards cannot possibly be achieved immediately in Czechoslovakia's current economic system, public respect for the whole environmental approach will be undermined. The alternative is strong law and regulation, with a phasing-in period (see paras. 10 and 16). A second component of effective enforcement is construction of a system and allocation of resources for compliance monitoring. Czechoslovakia's enforcement inspectors must have a responsive capability for determining emission practices of regulated sources. Third, Czechoslovakia must establish procedures for resolving disputes between the judgments of its enforcement inspectors and the inevitable counter-claims of the regulated parties. In a centrally controlled economy, this may seem unimportant. A free market economy, however, implies equal standing under the law, and opportunities for dispute resolution should be provided to balance private enterprises' substantial incentives for delaying or avoiding costly compliance. Finally, it will be impractical from the point of view of administrative resources to structure a compliance monitoring and enforcement system which addresses all pollution sources immediately. Criteria should be developed for establishing enforcement priorities. Two examples might be: importance in setting a legal precedent, and potential harm to human health and the environment.

10. Czechoslovakia is evolving towards the European approach to environmental management, which involves a progression from law to standard-setting to negotiated permits to enforcement. While it makes sense to construct law and standards that are generally consistent with those in Western Europe, it makes equal sense to phase-in implementation of the laws and standards taking into account technical and economic feasibility.

11. These regulatory measures must be reinforced by market mechanisms such as a system of pollution fees for obvious, demonstrated pollution threats. Initially, it may be difficult to gauge, even in this limited application, a level of pollution fee or charge which will correctly provide incentives for developing substitute practices or products while not leading to unacceptable market consequences. While the necessary analyses are being carried out, a practical, quick first step will be to gradually increase the real (inflation-adjusted) levels of existing charges over time.

12. Turning directly to the needs for environmental protection institutions and policy, Czechoslovak authorities intend progressively to establish an integrated, decentralized environmental management system:

- Policy and the phasing-in of regulatory standards will be accomplished on the basis of cross-media² scientific and economic analysis. Media-specific approaches to management are sub-optimal both from the environmental perspective, because pollution may be transferred rather than mitigated and residuals are unaddressed; and from the standpoint of economic efficiency, because resources

² Air, water and soil.

can be misallocated to low-priority problems. The integrated, or cross-media, approach uses risk information about pollution threats to human health and the ecology as the basis for establishing priorities across all problems. This implies, of course, establishment of a strong monitoring and risk information system. Risk priorities are then combined with knowledge about the technical and economic feasibility of control of these pollution threats to determine an effective, practical plan of regulatory action.

- Decentralized environmental management is also most efficient both for protection of environment and for cost-effectiveness purposes. When environmental policy, standards, and enforcement are established at the national level, decisions are necessarily general. By decentralizing decision-making authority, Czechoslovakia will encourage the tailoring of environmental action to the specific needs of the geographical area. This will help ensure that the specific, unique environmental threats of the area will be addressed but, at the same time, will discourage imposition of general and costly controls on low priority sources.
- Any form of environmental management should include and encourage a variety of procedures for public participation in decision-making, if for no other reason than this participation will encourage public ownership of the enforcement and economic implications of responsible environmental decision-making.

13. Because of the delicacy of the trade-offs between environmental values and other social benefits, Czechoslovakia intends to ensure strong public participation in environmental decision-making. Formalizing procedures for public access to information and a public role in decision processes would be made particularly useful:

- by developing an environmental impact assessment process, the results of which would be made public prior to major public and private development decisions;
- by developing public review and comment procedures prior to the promulgation of significant regulation and policy; and
- by developing a system in which significant pollution sources would regularly publish information on their pollution emissions.

14. Czechoslovakia has not yet achieved a final definition of the nature and extent of the governmental role in environment. It is proposed that the following issues be given consideration as Czechoslovakia establishes its environmental management institutions.

15. In its most general sense, "environmental protection" might be said to include the linked consideration of:

- ecological protection and natural resource preservation
- human health protection from air, water, land, and groundwater pollution
- agricultural practices and the use of agricultural chemicals
- worker safety
- food safety
- consumer product safety

The Czechoslovak environmental agencies deal mostly with the first two items. The next five are handled with varying degrees of effectiveness by other agencies. Close linkage among the authorities responsible for the above aspects of "environmental protection" offers crucial benefits. It permits establishment of a comprehensive, integrated science and information base. It encourages development of consistent, non-duplicative regulation which, in turn, assists in public respect for and credibility of government decision-making. And it is efficient: public and private resources are conserved through broad priority-setting among problems.

16. A distinction should be drawn between "new" and "existing" pollution sources. "New" sources, whether financed from within or without Czechoslovakia (or some combination of both), should be expected to comply immediately with all laws to the extent appropriate, and should be required to receive a permit before beginning operation. Phasing (paras. 9 and 10) should only apply to existing sources. Several criteria seem particularly important to the specific determination regarding length of phasing-in time. These are: nature and extent of the pollution threat to human health and the environment; technical and economic viability of implementing controls; administrative enforceability; and public demand. Effectively applying these criteria requires a mix of actions including risk assessment, identification and analysis of pollution sources, and economic analysis.

17. A useful beginning step toward identifying the most significant pollution sources and a scheme for phasing in application of standards would be an environmental audit program for industrial enterprises. Such a program has the benefit of promoting adoption of improved housekeeping and other ways for waste generators to reduce their environmental emissions quickly at little or no cost. It should emphasize training of enterprise and local consultant staff and establishing an environmental code of conduct for business enterprises.

CHAPTER II

Environmental Problems

18. This chapter summarizes some of the technical information collected by members of the joint mission. It discusses human and ecological effects, sources of pollutants, monitoring information and exposure assessment, information and data systems and research. In general, the data indicate that pollution in several parts of Czechoslovakia exceeds most western standards, and is a serious threat to the environment and human health.

19. Although there are significant impacts on human health and ecological systems and resources in Czechoslovakia resulting from environmental pollution, there are large gaps in the information and data that are available specifically for the Czechoslovak situation. Consequently, the likelihood of adverse effects in some instances (e.g., hazardous waste sites) must be inferred from the general scientific literature, relating the data that are available in Czechoslovakia to cause-effect hypotheses that seem plausible. For most effects on human health and some ecological effects (e.g. ecological effects from water pollution), insufficient data are available to establish cause-effect relationships with confidence, so that alternative hypotheses as to cause, and as to non-pollution related contributing factors cannot be ruled out.

A. Human Health Effects

20. Like other former Eastern Bloc countries, Czechoslovakia finds itself in a relatively unfavorable position with regard to life expectancy when compared with other industrialized nations. At present, the available data are of insufficient quality and quantity to permit a definitive analysis of the historical evolution of health status in Czechoslovakia. The existing data do, however, give important insights into problems of public health and into determinants of health status. As of 1988, infant mortality is at a level approaching that of the West, i.e., it is close to that of the United States, Belgium and the United Kingdom. In contrast, average life expectancy is significantly (5 to 7 years) lower. The primary reasons for the failure of Czechoslovakian life expectancy to increase during the past 25 years seems to be related to the fact that cumulative mortality from the chronic diseases of mid and late life has not been reduced during a parallel period of marked reductions in the West.

21. The period of relative decline in Czechoslovakian health status has occurred at a time of marked decline in the quality of the physical environment. So, for example, levels of sulfur dioxide during the 1980s were quite high when compared with levels in the United States and Canada, both known as major emitters of sulfur dioxide. Levels of sulfur dioxide in Northern Bohemia, Prague and other places have been measured at above 2,500 micrograms per cubic meter per 24 hours during periods of inversion. In addition, data are available that indicate that levels close to 1,000 micrograms per cubic meter per 24 hours, lasting for several days or even weeks, are reached regularly in Northern Bohemia. Furthermore, the methodology utilized for some of these measurements may underestimate the actual levels in the environment. These data must be

contrasted with data on annual averages for sulfur dioxide which are not much higher in Czechoslovakia than in other parts of the world.³ Similarly, there are data which show wide variations in metal concentrations in drinking water samples, where the high end of the range includes concentrations which may be of health significance. Other data show that lead, cadmium, PCBs, and other chlorinated organics are present in food including meats, dairy products, bread and vegetables, sometimes in high concentrations. There are also data from several limited studies that have shown, for example, the presence of chlorinated organics in air from incineration, elevated levels of lead in children's teeth in the vicinity of a smelter, elevated levels of arsenic in blood, urine, and hair in boys living in the vicinity of a power plant in Slovakia. One study measured the average blood lead levels in boys and girls living in the Pribram area and in control areas. For both sexes, the average blood lead level was above 30 micrograms per deciliter in both areas. This is extremely high by western standards. Again, serious questions of quality assurance have been raised with regard to this study. Monitoring issues and quality assurance are discussed later in this report. It is important to note, that while there are data that show significant exposures to toxic substances in air, water and food, they are insufficient to permit an analysis of the health impact on the population. Good monitoring data, obtained with defined quality assurance procedures, need to be obtained, and integrated into multi-media exposure assessments. Such assessments, together with other data, can then be used to estimate risks to the exposed populations, and then utilized as the basis for setting priorities and making decisions about the need for pollution control.

22. Czechoslovakia has set ambient standards for a number of pollutants in the air and water. Often, these standards are more stringent than standards in the West. For example, the Czechoslovakia 24-hour standard for SO₂ is 150 micrograms/m³, compared to the United States standards of 365 micrograms/m³. The basis for some of these more stringent standards is not apparent, especially in light of the lack of enforcement; it would be useful to understand the health benefit that would be obtained by this extra measure of stringency.

23. It is important to note that there are other factors besides the decline in the physical environment which may explain the relative decline in health status of Czechoslovakians compared to Western countries and, also help explain some of the regional variations observed in the country. When available data are analyzed, it may be seen that socio-demographic factors are indeed powerful determinants of health status, as they are in other countries. In particular, the distribution of specific groups such as the Gypsies, and other such demographic considerations seem closely correlated with health status. Analysis of the data leads to the hypothesis that there are two major patterns which adversely affect the health of people in Czechoslovakia. One, characterized by high infant mortality and mortality from respiratory diseases is a pattern associated with underdevelopment. The other, found particularly in the northwestern regions of the country, is characterized by high rates of mortality

³ There are, however, problems in comparing data from Czechoslovakia with data from other parts of the world, because of differences in analytical methods and in the aggregation, statistical analysis and presentation of the data.

from cancer and circulatory diseases. It seems to be most closely associated with high levels of environmental pollution, and, also, of social disruption as symbolized by high divorce rates. The fact that these two trends coexist makes the process of estimating the relative impact of environmental and socio-demographic factors on health status very difficult.

B. Ecological Effects

24. Natural resources, ecosystems, and biodiversity in Czechoslovakia are seriously threatened. A significant percentage of the total flora and fauna in Czechoslovakia are considered endangered. In 1988, 61 percent of the fish and 95 percent of the amphibians, 91 percent of the reptiles, 52 percent of the birds, and 60 percent of the mammals were considered endangered. These numbers are very high in comparison with other countries. (While considered endangered in Czechoslovakia, some of these species may be found in other countries.) In the past, forest and agricultural management practices have had adverse ecological effects through the development and cultivation of large monocultures of nonnative species. Terrestrial biodiversity is threatened largely by land use practices and by air pollution. Aquatic effects seem to result largely from pollution of water and as a result of the destruction of breeding areas through channelization and other hydrological alterations. Since the early 1960s there have been reports of acute and chronic injury and death to wildlife. These effects have ranged from debilitating diseases to die-offs, and have been associated with air and water pollution and indiscriminate use of pesticides.

25. Air pollution, including sulfur dioxide, nitrogen oxides, acid deposition, and trace metals are considered responsible for both injury and death to large portions of forest regions in northwestern Bohemia and northern Bohemia, Moravia and Slovakia. According to a United Nations survey in 1988, a total of 70 percent of the forests in Czechoslovakia are damaged, with 22 percent classified as medium damaged and more than 5 percent classified as dead or dying. Forest damage was first noted about 40 years ago, and the rate of forest death has been observed to be increasing. Even if emissions are reduced, damage to forests is predicted to continue as a result of the lag time in manifesting damage. Estimates are that one-third of the forests have been lost or have reached the first stage of irreversible damage. The problem is more severe in the Czech Republic than in Slovakia. Acidification of soils has occurred, and has led to the leaching of important nutrients from the soil. Forestry management practices such as clearcutting have contributed to water pollution and soil erosion.

26. The primary threats to the parks and preserves in Czechoslovakia are thought to be air pollution and overuse by visitors. So, for example, in 1984 it was estimated that 75 percent of the protected areas in the Czech republic had been affected by air pollution and that 25 percent had been seriously damaged.

27. The primary impact on aquatic resources is point-source water pollution from urban and industrial areas and non-point source pollution from agriculture. Water pollution is caused by uncontrolled industrial and municipal discharges, agricultural runoff, air emissions and deposition associated with industrial and energy sources, and accidents and spills. Seventy percent of all waterways in Czechoslovakia are reported to be heavily polluted. Rivers and streams in

Czechoslovakia have been significantly affected by alteration of their hydrological regimes, especially by channelization. For example, only 10 percent of the major streams in the Czech Republic are considered to be in their natural state. Reproduction of native fish species has been reduced because natural breeding areas have been destroyed.

28. Agricultural practices have had a significant adverse effect on the natural resources of Czechoslovakia, especially on surface and groundwater. Most of the pollution is caused by organic matter, industrial fertilizers, pesticides and oil products. Runoff from animal wastes and overuse of fertilizers has caused high levels of nitrate in surface and groundwater. Average nitrate concentrations in groundwater have increased four-fold in developed areas. This phenomenon is prevalent in other countries of the region as well. As a consequence, hygienic regulations have been passed to reduce the occurrence of methemoglobinemia in children. Other natural resource problems associated with agricultural practices include soil erosion exacerbated by the cultivation of large fields and the lack of natural protection mechanisms, and pollution from contaminated fertilizers and pesticides. Overuse of soils for agricultural production has decreased humus content which has led to increased surface runoff of water. Much of the farmland in hilly areas is eroded due to inappropriate agricultural and forestry practices. There are also special problems, such as PCB contamination of cattle in the Czech Republic attributed to the painting of feed and water troughs with PCB based paints, and cadmium contamination of crops from the use of contaminated fertilizer imported from Africa.

29. Surface mining activities have disturbed large areas in Czechoslovakia, especially in Northern Bohemia. Some reclamation is attempted after mining; agricultural, forestry and natural landscape reclamation has been partially successful. Some problems exist with spoil banks containing high levels of toxic materials.

Sources

30. There are a number of significant sources of air pollutants in Czechoslovakia. Power plants and large industrial point sources have been characterized as major emitters, and their emissions estimated. Other sources, including home heating using lignite, motor vehicles, and area sources in general, small facilities such as foundries, landfills and hazardous waste sites, have not been well characterized. Some pollutants such as SO₂ are transported over great distances, and as a result, the country is both an 'importer' and 'exporter' of these transboundary pollutants. However, as the table below shows, Czechoslovakia has been a net exporter of SO₂ in recent years.

TABLE 1: _____

	Imports of SO ₂			Exports of SO ₂			<u>Exports</u> Imports	
	1985	1986	1987*	1985	1986	1987	1986	1987
Austria	3	5	4	24	27	27	5.40	6.75
Fed. Rep. of Germany	24	18	28	39	62	47	3.44	1.67
Poland	74	89	95	109	142	145	1.59	1.52
USSR	4	3	2	107	103	107	39.33	53.50
German Dem. Rep.	95	90	128	58	79	84	0.87	0.65
Hungary	40	47	45	28	21	31	0.44	0.68
Total:	240	252	302	365	434	441	1.72	1.46

*Preliminary data

Source: "The Current Status and Development of the Environment in Czechoslovakia. Geographical Sections of the Czechoslovak Society for Biology, Ecological Group of Economic Research Council in CSFR in cooperation with the Czech Union for Defense of Nature."

31. There is only anecdotal information about accidents, spills, and releases during times that facilities are malfunctioning. While such releases are likely to represent a significant exposure source, no data are available to assess this issue. REZZO is the emissions and atmospheric pollutant source registry in Czechoslovakia. Some large source emissions, i.e., fuel-combustion facilities greater than 5 MW, are listed in REZZO 1. Emissions calculated for each enterprise and are updated once a year. This registry represents the major source of information about emissions of air pollutants in Czechoslovakia.

32. There are also a number of significant sources of water pollution. Agricultural practices, industrial emissions into surface waters, forest management practices, sewage treatment plants, and small industrial facilities are all important. Agricultural practices that change the physiognomy of the landscape, such as channelization and the destruction of wetlands areas, change and decrease the ability of natural systems to cope with environmental stresses. Over-fertilization and extensive use of agricultural chemicals have led to contamination of ground and surface waters with pesticides and nitrates. Many enterprises emit their waste streams directly into surface waters, generally, with little or no controls, and agriculture and municipalities are large sources of pollution. There are a nearly 2,500 water systems without facilities that discharge their sewage into surface waters virtually untreated. When they exist, sewage treatment plants often have secondary treatment, but some do not - it is not clear the degree to which such plants are a major source of toxic pollutants. It is also not clear the degree to which untreated sewage is a contributor to health or environmental risks. Ground water contamination at some of the large industrial facilities appears to be extensive. Ground water also has been contaminated by hazardous waste sites, although little information is available.

Mine tailings, and ash piles are ubiquitous, and often placed and managed so that run-off goes directly into a river or stream.

33. It is not clear whether or not municipal landfills represent a serious source of pollutants affecting human health or ecological resources. Information about the location of landfills is available, but there does not appear to be good information about the types of wastes accepted, whether industrial and hazardous wastes are mixed with household wastes, etc. Hazardous waste sites abound, and information as to their location is available. There are several types of such sites, including facilities that have been in existence for decades, where the contents of the site are completely unknown; sites associated with currently operating industrial facilities, where the contents are known to some degree; and military sites, which may contain many exotic contaminants, but which have not been well characterized so far. Attention also needs to be paid to the problem of storage of spent fuel from nuclear power stations. The economic conditions of spent fuel transportation from Czechoslovak nuclear power plants to the USSR are currently being clarified, while the possibility of acceptance of spent fuel by other producers from abroad is also being evaluated.

34. Exposure to ionizing radiation may be of greater concern than simply concern about wastes. There is anecdotal information about problems at nuclear facilities, and about accidents, but little scientific data. Since the accident at Chernobyl an extensive monitoring network has been put into place, which provides useful information. However, past exposure may be of great significance. Data from sediment cores shows a peak of radioactivity that correlates well with the accident at Chernobyl, but, there is an even larger peak, whose source is unknown, that dates from the early years of the 1960s.

35. Food is a major source of exposure to environmental pollutants. PCBs and other similar chlorinated organics seem to be ubiquitous, as are pesticides and heavy metals. Data that are available indicate that food may be the major source of exposure for some of these pollutants, and for others, can be a major contributor to body burdens. The degree to which additives to feed, such as hormones and antibiotics, and food additives generally, are present in food products is not known.

C. Monitoring and Emissions

36. Air emissions are estimated in Czechoslovakia from process data and other information, and are compiled in a computerized data base. Characterization is incomplete, however, because of a lack of emissions monitoring to assess the validity of the estimates - which are provided by the sources themselves. As a result, the quality of the emissions data is speculative to a significant degree. This is especially true for NO_x , particulates, and organic compounds. In addition, estimates for emissions are annual estimates, and consequently do not provide information about peak emissions, or emissions from batch operations. There is no information about accidental releases, although human health and ecological effects have been reported.

37. There is an extensive network of both automated and manual air monitors for sulfur dioxide, nitrogen oxides and particulates in all parts of the country.

Several significant problems make these data less useful than they might be. One example of such a problem is that the measurement of sulfur dioxide is done by two different methods, depending on which government entity is responsible. The two methods are based on different analytical approaches and provide results that are difficult to compare. The main problem, however, is that while extensive networks exist, only a few pollutants are measured. Thus, there are extensive data about concentrations of sulfur dioxide (SO₂), nitrogen oxides (NO_x) and particulates in air, but little information about heavy metals and organics. Several industrial facilities carry out limited monitoring in the vicinity of their plants, and a number of studies have provided information about pollution in particular geographic areas. The monitoring data for SO₂ and NO_x are centrally gathered and computerized, but data regarding the other pollutants is not, so that there is no single source for information about pollutants in air. One further complication is that monitors often have been located for administrative convenience, so that maximum levels may not have been measured.

38. The situation with regard to water is similar to that in air, except that there is only a partially comparable emissions inventory. Monitoring is extensive geographically, but very limited in terms of the pollutants measured. For most surface waters measures such as biological oxygen demand are available, as are total suspended solids, and chemical oxygen demand. Groundwater is monitored less extensively, although information about nitrate levels is generally available. There are a few studies which provide some information about other pollutants, although they are often limited in time and space. Occasional information is available, for example, about the levels of PCBs in water, as well as some other chlorinated organics and heavy metals. Data about water pollution in Czechoslovakia are centrally gathered for a few primary pollutants, but no system exists that collects or integrates information about other pollutants; so that as with air, no single source exists for information about pollutants in water.

39. There is no general monitoring program to determine the presence and concentrations of pollutants in soil, although there is information about classical soil characteristics such as humus content, erosion, etc.

40. In contrast to the above situation for air, water, and soil there is relatively extensive information available about contaminants in food. A comprehensive network exists to measure the levels of a large number of contaminants, including chlorinated organics, pesticides, herbicides, and heavy metals.

41. The main drawback to this otherwise laudatory system is that results are not obtained and reported in a timely manner, so that the applicability and utility of the information is limited to 'after the fact' evaluations. In the Slovak Republic the data are gathered, computerized and analyzed at the Institute of Food in Bratislava, and regular reports are provided to governmental agencies and to the public. In the Czech Republic no similar institution exists, although data are gathered through the Veterinary Institutes in the Department of Agriculture.

42. Ecosystems are extensively scrutinized in Czechoslovakia for signs of change. As a result, there is a great deal of information available about the

health of forests and other natural resources, and of some of the stress and exposure factors that are thought to be associated with ecosystem health. There is no statistically based network however, which measures both indicators of effect and of exposure. Consequently, information of various types is available, but our ability to interpret the data and to associate cause to effect is limited.

43. Human health (but not necessarily 'environmental health') is perhaps the single most intensively measured parameter in Czechoslovakia. As a result of the system of central and regional health and epidemiology stations there is extensive information about individuals and populations in both the Czech and Slovak republics. When circumstances dictate, measurements are made of blood, urine, hair, etc., although no overall plan exists for such efforts. The information gathered is largely for use by the medical community and so is often inadequate for use in western-style epidemiological studies. As a result, much of the available information cannot be used to suggest or to establish specific cause and effect relations.

Exposure Assessment

44. Exposure assessment is the process of measuring or estimating the intensity, frequency, and duration of exposures to an agent currently or previously present in the environment, or of estimating hypothetical exposures that might arise from the release of new chemicals into the environment. In its most complete form, it describes the magnitude, duration, schedule, and route(s) of exposure; the size, nature, and classes of the populations exposed; and the uncertainties in all estimates. Exposure assessment integrates information about the concentration of pollutants in the ambient environment together with other information to estimate the amount of pollutant that actually reaches a target in the organism and can therefore cause an effect. Exposure assessment is not well developed in Czechoslovakia, perhaps because of the historical compartmentalization of information. In recent years, the West, and particularly the U.S., has been moving towards the concept of total exposure assessment. The development of this concept has permitted a much better understanding of the amount of a pollutant or toxic material that can actually reach a target to exert an effect on the organism. There are large gaps in the data that are available in Czechoslovakia, and the data that have been collected are often fragmented and not centrally available. Consequently, this type of assessment is generally infeasible. In some studies, where information has been available about the concentration of a specific pollutant in a number of media, a multi-media assessment has been attempted. These efforts have been rare.

45. Even short of total exposure assessment, data are generally not available to understand the exposure of people to pollutants that are present in several media. Understanding of this kind is important for several reasons. First, for a large number of pollutants it is critical to know the total intake into the body from all sources, since the aggregate amount may be sufficient to pass a threshold for an effect to occur. Second, the human body may partition and store the pollutant taken in and release it over a long time into the future, causing a chronic exposure and effect. Third, the human body may react differently to the same pollutant taken in different ways. So, for example, arsenic that is inhaled may cause primarily lung cancer, while arsenic ingested

in drinking water would cause cancer of the skin as well as other internal cancers. As a result of this lack of information, human health studies are often extremely difficult to interpret.

Research and Data Development

46. At present, many government and non-government institutions perform research that is important to understanding the impact of environmental pollution on human health and the environment. It is not clear whether or not this research is planned, organized and implemented to provide data that will be useful for understanding and solving environmental problems in Czechoslovakia. There does not appear to be a central framework in which research is planned and results integrated. Modern methods of analysis are often unavailable, and researchers may not be familiar with the state-of-the art in a number of disciplines. Data development is similarly hampered. The research "establishment" is being transformed as a part of the more general change to a free market economy. There is some concern that important research that has been underway for many years, and has made important contributions may now be eliminated because it is unable to "compete" in the new environment.

CHAPTER III

Proposed Responses

A. Economic and Sectoral Policy

47. As discussed in Chapter I, the most pervasive near-term improvements in environmental quality will come from economic and sectoral policy changes. The removal of resource and production subsidies and of other barriers to the proper functioning of prices and markets will promote more efficient resource utilization and a restructuring away from some of the most polluting and resource-intensive sectors of the economy. Government policies intended explicitly to improve environmental quality should be consistent with, and also can build upon, these broader economic reforms. In particular, as broad economic reform measures are introduced, the Federal and Republic Governments gradually can increase their reliance on market-based incentives to promote pollution prevention, internalize environmental costs, and move toward sustainable resource utilization.

48. Economic instruments for environmental protection through 1989. Czechoslovakia adopted numerous pieces of legislation defining and setting ambient standards for most major pollutants between 1965 and 1980. A number of these standards, such as the ambient air standards, are frequently more rigorous than those currently embodied in Western industrial countries' legislation. At the same time monitoring, inspection and enforcement systems were set up.

49. Although Czechoslovakia had adopted pollution charges, fines and user fees, they played a marginal, if any, role in implementing the national ambient environmental standards. Revenues from charges, fines and fees were earmarked to finance environmental investments. Air pollution fees were set in 1967, and have remained constant since then. Thus, as the cost of other factors of production has increased, the share of emission charges in total costs has declined. Moreover, since the share of pollution abatement costs in production exceeds the share of emission charges, the structure of charges provided no incentive to polluters to reduce their emission levels.

Pollution Charges as Percent of Production Costs for Selected Industries

Table 2: Pollution Charges as Percent of Production Costs
for Selected Industries

<u>Sector</u>	<u>Air Pollution</u>	<u>Water Pollution</u>
Fuels	0.59	0.88
Electricity	1.84	1.59
Metallurgy	0.005	0.74
Chemical	0.007	0.88
Glass	0.0027	1.75

50. Water pollution charges, too, while recently doubled, are still set at levels based on past investment and operating costs; there is therefore no incentive to adopt measures to improve water quality. User charges for water use have been set uniformly for the whole country and do not reflect the regionally differentiated cost of water. The rates set for household usage are below operating and maintenance costs of water delivery and sewage treatment.

51. Since economic instruments to implement the environmental policies were ineffective, Czechoslovakia relied on non-market, regulatory enforcement of standards. However, as many of the polluters were unable to meet these standards, they obtained "exceptional permissions" and thus avoided compliance. Other polluters were considered in compliance while being permitted to exceed standards by payment of pollution fees. Enforcement of norms, standards and regulations by institutions responsible for the protection of the environment was therefore highly uneven. Lack of public participation concealed the magnitude of the environmental problems and significantly weakened possibilities for effective monitoring, inspection, enforcement and remedial actions.

52. Public investment in environmental protection has averaged about 0.4 percent of GDP during the 1975-85 period, declining from 0.5 percent of GDP in 1971-75 to 0.3 percent in 1980-85. These figures, while not insignificant, are, however, below comparable public environmental investment levels in other Western industrialized countries where much of the investment burden is carried by the private sector. Furthermore, the institutional inability to set clear, sustainable priorities resulted in an investment portfolio aimed at treating symptoms, not causes of environmental problems--including, for example, sewage treatment, particulate control on power plants rather than correcting pricing distortions. While environmental protection related investment expenditures were projected to increase to nearly 2 percent of public investments for the 1986-90 period and 0.6 percent of GDP, in the absence of improved macroeconomic policies, such investments can not be expected to have the desired effect.

Investment in Environmental Protection in Czechoslovakia

Table 3: _____

	<u>1971-75</u>	<u>1976-80</u>	<u>1980-85</u>	<u>1985-90</u>
Environmental investments (billion Kcs)	8.2	9.7	7.5	18.3
Share of total investments	1.35	1.27	0.92	1.92
Share of GDP	0.5	0.4	0.3	0.6

(i) Economics for a New Environmental Policy

53. The role of macro-economic reforms. The far-reaching macro-economic reform program that Czechoslovakia has decided to undertake also affords a unique ex ante opportunity to address the underlying causes of environmental degradation, in particular, if the guiding principles, institutions and instruments of macro-economic, sectoral and environmental reforms are addressed as an interrelated nexus. For instance, measures aimed at protection of the environment clearly cannot be treated in isolation of energy, industrial and agricultural policies. Indeed, macroeconomic and sectoral reforms will lead to significant environmental benefits. As an example, it is estimated that reductions in state subsidies will lead to reduced SO₂ emissions of at least 25% by 1993.

54. Improvements in broader economic efficiency sought through inter alia (i) a movement to free pricing in a market framework where prices better reflect long-run marginal costs for the full life-cycle of the product or service; (ii) realistic pricing of foreign exchange; (iii) imposition of a hard budget constraint with the elimination of direct and cross-subsidies; (iv) industrial restructuring; (v) increased private ownership; and (vi) legal and regulatory reforms will encourage more rational use of scarce resources and in and of itself reduce the flow of pollutants. When, in addition, these macro-economic reforms are coupled with realistic pollution standards, a rational structure of charges, fines and fees, and with effective monitoring, inspection and enforcement, the ensuing framework will provide clear signals and strong incentives to producers and consumers to increase use efficiency of material and energy per unit of output, recycle and reuse recoverable resources (water, solids, etc.) and dispose of wastes (direct environmental actions) more safely. The pace at which Czechoslovakia's environment is improved will therefore be conditioned by the pace of implementation of the overall reform program.

55. Sectoral policies. As they are introduced and take effect, sectoral policies which have been announced by the Government or are under active consideration should have important beneficial impacts on environmental quality. In the energy sector, the Federal Government has announced its intention to increase energy prices to fully reflect economic costs, including environmental costs, of energy production and use. If combined with proper valuation of the

Koruna, elimination of transport subsidies for coal, and a framework for allowing differential coal prices based on quality, this should result in major shifts from use of low-grade and environmentally degrading coal to use of natural gas and higher quality or cleaned coal. The Government also has stated that it intends gradually to reduce uneconomic coal production and to stimulate expansion of and switching to cleaner fuels by the electric power industry, both of which are logical outcomes of changed energy pricing policies. In industry, the main impact should come from dramatic reduction in ferrous and non-ferrous metallurgical production, which is environmentally degrading as well as in many cases uneconomic. Also planned, and also likely to occur anyway in response to market changes, are reductions in other heavy industries such as cement and heavy machinery. In all industry sectors, full-cost pricing of raw materials and energy will decrease wasteful use of such industrial inputs, with resulting decreases in the environmental impacts of production and use of such inputs. In agriculture, the elimination of subsidies of pesticide and fertilizer use will reduce a major source of contamination of surface and in some cases ground waters as well as, in the worst instances, of land itself.

56. The current thinking on the role of economic instruments. The basic principles of polluter- and user-pays have now been adopted by the decision makers in the two Republics responsible for the economic components of the new environmental policy. As a result decisions have been taken to increase the role of economic instruments and to add new pollution and user charges. There is a consensus as to setting the rates of these charges centrally in each of the two Republics and to earmark those charges to Republic Environmental Funds. The two Ministries are also proposing the introduction of a set of environmental taxes as part of the tax package reform scheduled for adoption for January 1993.

57. The role of the Republic Environmental Funds are seen as lending instruments and as a source of direct subsidies to polluters, especially to those in the hot-spot areas. Subsidies, both direct and indirect (such as tax holidays, interest rate subsidies, etc.), are viewed by Ministry officials as an important instrument in improving the quality of the environment.

58. Decentralized environmental market-based economic instruments. The extent to which Czechoslovakia will rely more heavily on command-and-control (CAC) tools over market-based instruments (MBI)⁴, and on a centralized versus decentralized environmental management framework, will affect the overall cost the economy will have to bear and pace at which its environmental goals are met. In addition to the financial burden, these costs will also include the cost of information, of control and management. In Western industrialized countries it has been demonstrated that use of MBI, where practicable, ensures that remediation is done at least cost to society as the costs of pollution abatement

⁴ CAC policies include inter alia emission regulations, regulations of processes as well as inputs and outputs while MBI policies rely inter alia on pollution charges, tradeable emission permits, deposit refund systems, taxes, tax-credits and subsidies.

are shifted to the polluter. The effectiveness of MBI requires decentralization⁵ of environmental management as day-to-day management will be facilitated, and charges, fines and fees will be effectively mobilized and put to their most efficient use. This is not to suggest that there is no role for CAC to play. Since it will take time for the institutional framework of the new market system to become effective, the CAC approach is probably better suited for the transition period.⁶ Nevertheless the Government intends to rapidly move towards greater recourse to MBI. While at the beginning of this process economic instruments will primarily perform a revenue generation function for environmental investments, as market conditions and an adequate institutional management system are established, they will play a key role in determining least-cost solutions for pollution abatement and prevention. During the transition years therefore, the environmental management model is likely to be a blend of CAC and MBI, with greater emphasis given initially to CAC. Even over the long-term however, certain aspects of pollution control will depend on effective CAC tools. For instance, while management of current air and water pollution abatement can best be effected through MBI, the establishment of national pollution standards, the prevention of toxic and hazardous waste production and the clean-up of "orphan" toxic waste sites, in the short term must by necessity, be done by CAC measures. Decentralized management might reinforce national priorities set through CAC by enacting and enforcing stricter local standards.

59. A gradual introduction in the transition period of an integrated environmental management model⁷ assumes a move towards a decentralized economic system for environment protection. Under a decentralized management model the use of basic economic instruments for environment protection would be determined by eco-basin authorities as for instance in the French or Netherlands' model. The collection of pollution charges would be their responsibility. Local communities would form eco-parliaments and decide on an environmental strategy for their eco-basin. The pace at which they would decide to comply with Federal

⁵ Decentralization of environmental management does not mean that the Central Government is relieved of its role in environmental protection. The key difference is that the search for least-cost solutions under the decentralized model is done at the regional level. It should further be noted that there are operational limits to the degree of decentralization of environmental management. The unit to which decentralization should be delegated should be large enough to prevent a single (or few) polluting unit(s) from being able to influence overall policy choices.

⁶ In Poland for instance, the absence of a competitive market environment has permitted large industrial concerns to retain monopoly powers during the transition. In response to higher input costs and pollution charges, some of these firms have not changed their production efficiency, but simply reduced output and passed the added costs on to consumers.

⁷ For more on Integrated Environmental management models see Integrated Pollution Control in Europe and North America.

environmental ambient standards would in turn, influence the cost of pollution abatement, and reflect their willingness to pay through pollution and user charges. Since in the end the pollution abatement and the cleaning up of the environment has to be paid by the local communities, and this will have an impact on income distribution, the public approval for these actions must be obtained.

(ii) Economic Instruments for Environmental Protection

60. Economic instruments for environmental protection provide an on-going incentive for pollution abatement and to stimulate technological changes. Use of economic instruments also allow for more flexibility in the adoption of abatement measures and in the enforcement of ambient standards. A pragmatic approach to achieve rapid progress in environmental protection suggests that economic instruments will be used to complement direct regulatory measures. However, because of the uncertainty as to the reaction of polluters to the economic instruments and the difficulties associated with determining economically proper rates (e.g. information costs), economic instruments will initially serve to generate revenue for environmental funds, while direct regulatory measures, provided they are enforced will force changes in polluter behavior⁸. A pragmatic approach to achieve rapid progress in environmental protection therefore suggests that economic instruments will be used to complement direct regulatory measures.

61. Pollution charges will be used to change the behavior of polluters and to generate revenue for environmental protection. The rate structure of these charges as well as the efficiency of their collection determines the role they can play in pursuing the goals of environmental policy. In the case of Czechoslovakia the rate of air and water pollution charges has been too low to generate sufficient revenues that can be used to meet the financial requirements of environmental protection. At the same time, the low rates have had no impact on the level as well as on the structure of output, and on the introduction of environmentally sound technologies. Therefore pollution charges need to be substantially increased. Nevertheless, during the transition period pollution charges will continue to perform primarily a revenue generating function.

62. User charges aim at increasing user efficiency of natural resources. For instance, the current rate for drinking water for households and industry, is generally below the operating and maintenance costs of the water utilities. Water intake fees are very low and have remained so for long periods. The rate structure does not reflect geographically determined conditions of water quality and availability. This has resulted in a relatively high demand for water for households, industry and the public sector, and thereby created excessive demand for costly water projects such as reservoirs, water delivery systems to shift water from one region to another. At the same time however, little notice was

⁸ Theoretically, ceteris paribus revenues can be expected to tend to zero over time if the level of pollution charges are appropriate. In practice, however, due to the difficulties, on the one hand, of evaluating the marginal abatement costs, and, on the other hand, the political process of negotiating an acceptable level of charges, the solutions are often sub-optimal.

given to water quality and to the maintenance of water supply networks. As a result, losses of water network have been estimated at around 30 percent. Water rates will have to be raised to fully reflect delivery, treatment and opportunity costs, and consumption metered so as to lead to more efficient resource use.

63. It is also evident that the particular level at which the charges, fines and fees will be set and gradually introduced, will affect the speed at which there will be compliance⁹. In the event charges are set centrally, that is by the Republic Ministries of Environment, and are unique to the large areas (Republic or Federal) without reference to the assimilative capacity of the specific areas, there will be the real risk of over- or under-charging. If charges and fines were set at a level to reflect heavily polluted areas, less heavily polluted areas would be penalized, with unnecessary loss of economic activity. Inversely, if charge levels are established at too low a level, heavily polluted zones like Northern Bohemia, would continue to add to the country's environmental problem. The above implies that the charge rates be geographically differentiated to reflect the assimilative capacity of the environment and at the same time be consistent with the regional environmental investment program adopted by the taxpayers of that region.

64. Decentralization of such decisions, subject to binding national standards would enhance economic efficiency as the local authorities would be able to assess the priority problem and the pace at which these problems will be addressed. Charges would then be set at levels to reflect the desired pace of remediation. If the standards are set too restrictively and unrealistically rapid compliance is required (e.g. zero pesticide residues in water immediately), then economic activity will either cease or the economic actors will seek ways to evade compliance.

65. Fines for non-compliance with environmental permits (levied on after-tax earnings, or in case of public sector from the budget) will also be earmarked to environmental expenditures. However, proceeds from fines should not be seen as a major source of financing, and should be treated as an extraordinary and exceptional source of financing additive to the primary sources of financing; charges and fees. In addition, to ensure compliance of potentially viable concerns without however rendering them unprofitable, pollution fines can be deferred pending a mutually agreed to compliance plan.

66. Taxation. Fiscal policy, using broad-based taxes with for instance a national incidence, could also be envisaged including for instance, a surtax on hydrocarbon fuels, a tax on the production of hazardous materials industries (as with the U.S. Superfund). Revenues from these taxes can either be placed into environmental funds, or further earmarked with, for instance, the tax on hazardous materials industries earmarked for hazardous and toxic waste site clean-ups, the hydrocarbon tax earmarked for improvements in vehicular pollution, etc. However, such direct earmarking for specific types of environmental protection would likely lead to a situation where the environmental funds are not

⁹ This will only be true if direct and cross-subsidies are eliminated, State monopolies broken-up, and bankruptcy allowed for.

necessarily used for those environmental projects which yield the highest net social benefits.

67. Investment tax credits can also be used, alone or in combination with the surtaxes. In addition, mineral resource extraction licenses and royalties should be introduced. These might allow for the capture of the social costs of mineral extraction and provide funds for subsequent land reclamation. The legal and institutional framework to allow for the issuance of development bonds, in particular to permit local authorities to raise capital needed to finance environmentally sound investments, might also be implemented.

68. Subsidies are used as payments and financial incentives to support the goals of environmental policy when the existing system of economic and regulatory instruments is not sufficient to internalize social environmental costs into consumption and production decisions. Subsidies (in the form of direct grants, interest rate subsidies, etc.) have also been used by policy-makers to broaden the scope and accelerate the pace of environmental activities when economic agents are lacking sufficient funding.

69. Direct subsidies have been widely used in some Western countries for water treatment and waste disposal, and to promote "end-of-pipe" solutions. The experience from these countries shows that subsidies do not promote efficient environmental solutions. "End-of-pipe" solutions supported by subsidies do not alter polluter behavior and there is thus no incentive to seek environmentally sound technologies. High shares of subsidies in investment costs of environmental facilities promote design of capital-intensive projects with excessive reserve capacity. In many eastern European countries, investment projects in the public sector for which direct subsidies were given were not properly maintained because of lack of adequate financial resources to meet operation and maintenance costs due to low user charges.

70. Environment funds. The public revenue generated from pollution charges, fines and fees will continue to be earmarked to funds for environmental investments¹⁰. Czechoslovakia has already had pollution charges earmarked to air and water funds. Authorities intend to merge these air and water funds into a single environment fund in each of the Republics. The use of such resources at the local level has not yet been fully clarified. During the transition period it is expected that local environmental outlays will be financed through funds delegated from the Republican funds. In the absence of new enabling tax legislation, recourse to local level resources--including permission to levy and

¹⁰ If polluters responsible for pollution can not be (or are not) identified, the polluter pays principle will clearly not serve to reduce pollution, and public financing for remediation will be called for. In addition, if all pollutants are not measured (e.g. phosphates) some user/polluters (e.g. farmers) would get a "free ride". Alternatively, in the absence of compensatory measures certain pollution charges can be income-regressive (e.g. per capita-based charges). In such circumstances public intervention is called for to share the burden more equitably.

retain taxes, or to raise financing through local bond issuance--is not likely to be used during the transition period.

B. Institutional and Human Resources Development

Institutional Roles

71. The year 1990 saw major changes in the way in which environmental management is organized in Czechoslovakia. In the Czech Republic, a Ministry of Environment was formed from units in the former Ministries of Interior and Environment, Forest and Water Management, and Agriculture. In Slovakia, a similar process resulted in a Commission on Environment - originally designed to be a small body with strong powers to coordinate the activities of the other Ministries. Subsequently, the Commission has evolved to resemble a line Ministry with considerable executive authority. At the Federal level, the former Environment Division of the State Commission for Scientific, Technical and Investment Development has become the Federal Committee on Environment. Each of the three bodies is headed by a Minister (and will occasionally be referred to as "the three Ministries").

72. In parallel with the general political debate over the appropriate division of responsibilities between the Federal and Republican levels, the discussion within the environmental field now seems to be nearing consensus. The Federal Committee is primarily responsible for: setting overall policy goals and the strategy to meet them; coordinating the activities of other Federal bodies with respect to the environment; establishing basic legislation and minimum environmental quality standards; maintaining a country-wide environmental information system; funding programs and projects of country-wide significance; supporting research into environmental technology; negotiating and ratifying international treaties and conventions; and, coordinating foreign assistance in the environmental field. As can be seen, the Federal role is largely one of coordination rather than execution of programs.

73. Close coordination between the federal and republic levels is ensured by an Environmental Kollegium, on which the three Ministers sit and which meets monthly.

74. The Republics play a major role in the formulation and implementation of environmental policy and programs. They are responsible for: setting detailed policy goals and strategies; coordinating the activities of other Republican bodies with respect to the environment; establishing detailed environmental legislation, regulations and standards, in consistency with the Federal framework; maintaining monitoring and information systems and disseminating results; operating inspectorate systems and imposing penalties on violators; assuring the quality of environmental work undertaken by regional and local bodies; supervising systems of environmental assessment (EA) for new investments; ensuring that individual enterprise restructurings meet environmental standards; establishing Republic environment funds; funding programs and projects of Republic-wide significance, both in the public and enterprise sectors; education and training of staff; supporting non-governmental organizations (NGOs); supporting research; and, undertaking public education.

75. While collaboration with neighboring countries is largely a federal responsibility, fruitful possibilities exist for collaboration at the republic (Czech-Bavaria) and even the municipal (Ostrava-Katowice) levels both in exchanging information and in joint planning of projects.

76. The appropriate roles of regional and local bodies has not yet been determined. The previous "top down" system, where local governments were merely tools of the central administration has been abolished and democratic local governments have been elected. However, their role in environmental management has not yet been determined. It is recommended that local governments have at least the following roles:

- urban planning, zoning, and other land use management-based environmental controls. Certain measures are logically within the power and ability of local governing bodies. Examples include standard physical planning and zoning; the protection of sensitive areas such as wetlands, stream valleys and floodplains; and requirements for erosion and sediment control during construction as well as subsequent stormwater management;
- supervision of water supply and sewerage enterprises in conformity with Republican standards. These enterprises should operate autonomously and along commercial lines wherever possible. This responsibility should include a pretreatment program to ensure industrial discharges to the public sewers do not damage the operation of municipal wastewater treatment plants;
- operation of (non-toxic solid waste collection and disposal systems. This responsibility should include collection and sale of recyclable materials from households and businesses;
- monitoring of local ambient environmental conditions; and
- general monitoring and inspection activities determined as standards are set by the Federal and Republic governments. For local governments these might include auto emissions inspections, well water testing, checking produce for unsafe levels of pesticides, and issuing citations for environmental nuisances such as excessive noise or visible smoke emissions.

In the larger cities, additional powers could be delegated from the Republic level. For medium and large towns and cities, specific environmental units should be established. It is recognized that it will take the local governments some time to develop the capacity to handle the above functions and that, in the interim, Republic-level agencies will have to play a stronger role.

77. There remains a set of problems that lend themselves to regional solutions. Experience in Western countries would suggest the role of regional bodies in environmental management (and other concerns) should most often take the role of coordinating the actions of several or more local jurisdictions which have both common problems and a need for common solutions. It should also be recognized that in some instances, cooperative solutions should be developed

among neighboring cities and towns. For example, two or three cities in close proximity to one another might most efficiently manage water supply or sewerage jointly, by means of a special joint or regional authority or district. The capability for creating such authorities probably would need to be granted or legislated on the national or republic level.

78. At a somewhat larger scale, watershed and airshed management is needed. For water, river basin (watershed) boards already exist. Though initially established for developmental purposes (navigation, flood control, hydropower etc), they have increasingly become involved in water quality issues. Given the considerable assets of these boards, in terms of technical staff, monitoring networks and laboratories, this report **recommends** that they be retained under the supervision of the Ministries of Environment and re-oriented to focus primarily on analyzing water quality problems and developing cost-effective strategies and project plans to reduce such problems. As a secondary function, they could undertake the planning phase only for water resource development projects. Consideration should be given to assigning taxing authority to the boards (or sharing the proceeds of Republic-level environmental taxes and charges) for the funding of water pollution projects, in a manner similar to the French Agences financières de bassin.¹¹

79. No regional "airshed" bodies now exist. However, given the rather localized character of air pollution, Air Quality Management Regions (AQMRs) should be established in the major black spots, governed by boards representing the regulatory authorities, local governments and the principal enterprises. The role of the AQMRs should be:

- to monitor air quality
- to implement air pollution emergency plans (this will require strong enforcement powers)
- to develop short and long-term plans for reducing pollution to acceptable levels in the most cost-effective way (this will require close cooperation from the enterprises concerned)

The AQMRs should have taxing authority (or a share of Republic-level taxes) in order to fund the implementation of their programs. However, it is recognized that they may not have the ability to fund some of the larger projects.

80. With such a system of regional air and water quality bodies, there would be little need for substantial regional "branches" of the Ministries of Environment, though local offices would still be needed to house inspectorate staff.

¹¹ Jansen, H. M. A.: "West European Experiences with Environmental Funds", (draft), December 1990.

Other Institutional Roles

Legislation and Enforcement

81. As Czechoslovakia evolves towards more democratic and market-based systems, the country will need to review its current approach to enforcement of environmental law and regulation. In democracies ruled by law, neutral mechanisms are needed to resolve disputes by the various parties under the law-- such as government and private sector entities. Neutral adjudicatory mechanisms might mean administrative courts, such as those enjoyed in Czechoslovakia prior to 1948. But these mechanisms might also be more informal negotiation or dispute resolution entities, particularly for minor matters. In market systems, private companies are geared toward profit, not compliance with centrally mandated environmental law. Strong government enforcement systems are needed to ensure that environmental costs are internalized in private sector resource allocations.

82. Effective environmental enforcement is a system. It begins with a pragmatic approach to development of environmental regulation and standard-setting itself: environmental authorities cannot be asked to enforce economic absurdity. Hence, the recommendation that Western standards be phased in over time. Second, an enforcement system depends on monitoring of emission sources, and enforcement authorities must have the capability to set priority for allocation of limited resources for this purpose. Third, enforcement officials must be sufficiently trained in legal or other dispute resolution procedures to be able to make a credible case against a non-complying regulated party. And again - the whole system assumes existence of an independent decision-making body committed to fair interpretation of the law.

83. Several laws and regulations pertaining to the environment are presently under consideration at the federal and republic levels. These include general laws on the environment at the federal level and regulations that address specific environmental issues which will be primarily implemented and enforced at the republic level. Regulations for the protection of forests, agricultural land, and wildlife are being drafted, in addition to regulations and standards for solid and hazardous waste management, radiation exposure, atmospheric emissions, and pollution of surface and groundwater.

Information Systems

84. Science was given high stature during the socialist regime; scientists had prestige and relatively free scientific inquiry was possible, though the results were not freely disseminated. As a result, environmental information in Czechoslovakia is now relatively plentiful, especially: data on ambient air and water quality; data on air emissions; data on food contamination; selected health data, and so forth. Existing scientific institutes have high credibility in their fields. Because of this, environmental data collection and publication tended to be designed by the scientists for their own needs. Though important in its own right, this "scientific" approach has limited utility as a basis for directing information system needs for environmental management purposes.

85. Environmental information systems should be "demand driven", that is, designed on the basis of users' needs, beginning with environmental management

needs; scientific specialists should help with this task, but the task itself should not be confused with the need for free scientific inquiry. Environmental management demands three kinds of information systems:

- comparative risk, which accumulates all complete and partial data for use by managers in establishing broad budgetary and regulatory priorities;
- risk management, which summarizes peer-reviewed information of a more particular nature. In the US, for example, there are systems such as the Integrated Risk Information System (IRIS), which contains summary information about the toxicity of chemicals to humans, as well as ACQUIRE, which contains information about aquatic toxicity to organisms in the environment. Systems like these, based on expensive, painstaking endeavor, are necessary to guide and defend the environment standard-setting process; and
- compliance information, for use in environmental enforcement (see paras. 36, 37). Enforcement evidence means monitoring information demonstrating that a source is emitting beyond levels mandated or agreed to in law, regulation or permits. This implies four problems. The first is how to allocate limited monitoring resources; this report recommends that they be aligned with the mitigation priorities identified in the following section. Second, enforcement authorities need to identify monitoring and laboratory equipment needs. Third, quality control procedures are needed to ensure the replicability and reliability of data. Finally, the data must be gathered for use in enforcement processes. Clearly, monitoring systems will serve enforcement needs best when they are designed in full consultation with the enforcement officials.

86. In addition to the needs of environmental managers and administrators and the scientific community, the information system must also serve other users, particularly, the press and the public. The public interest will often best be served by full disclosure of available data, especially to people affected by major pollution emission sources (paras. 30-35) or as part of an environmental assessment of a new investment (para. 96). The public also needs to be informed on changes in more general environmental indicators (e.g. total SO₂ emissions, river classifications) in order to judge the effectiveness of current programs. The international community needs to know of the results of Czechoslovakia's efforts to reduce transboundary pollution, greenhouse gases and the like.

87. Attention should also be focused on the most appropriate forms for disseminating information. Depending on the needs of the users, yearbooks, brochures, newsletters, scientific journals and data tapes will all have a role to play.

88. Design of a monitoring and information system to meet all these needs in a cost-effective manner is a complex task that will require some time to complete. Nevertheless, agreement on its conceptual design is an urgent priority, if only to inform decisions on the purchase of high-technology monitoring and laboratory equipment. System design will also need to define the

roles of the Federal and Republic Governments, as well as the specialized institutes. It is suggested that full implementation of a monitoring, information and dissemination system be broken down into a series of modules that can be funded separately, in order to accommodate the priorities of various potential donors.

89. Links to restructuring. While the need for close coordination between environmental planning and the economic restructuring that is now beginning is fully recognized in Czechoslovakia, few steps have yet been taken to achieve this. The inclusion of other technical ministries on the Kollegium is an important step but, so far, the environmental authorities are not fully represented on the bodies managing the restructuring and privatization processes. This report recommends that, at a minimum, each ministry appoint a high-level liaison staff member for industry and for energy to maintain close contact with other ministries and to represent the environmental viewpoint on their committees. At a later stage, small units may be needed within the ministries to undertake the necessary staff work. A secondary objective should be to improve coordination with the agriculture and transport sectors.

90. Links to the private sector. The three ministries will need to adjust their methods of operation as the enterprises they regulate are increasingly privatized. On the one hand, private ownership will make the locus of responsibility for pollution cleanup very clear and the environmental inspectors are likely to find it easier to enforce the law against individual polluters without having to take on a powerful Ministry of Industry. On the other hand, private sector managers are likely to be quite inventive in finding ways to avoid their responsibilities, including greater use of the court system to delay legal action. The three ministries will need to plan for these changes and mount special training for the inspectors and other staff dealing with regulatory enforcement. Related to this is the appropriate level of government support for private enterprises attempting to reach legal compliance (para. 92).

91. Links to the financial sector. The financial sector has an important role to play in environmental protection, especially through the involvement of banks in enterprise restructurings, in developing a system of commercial lending for enterprises investing in pollution control and in scrutinizing the environmental impacts of other projects proposed to them for financing. The environmental ministries will need to develop rules of procedure for these situations which make clear the respective roles of the banks and the ministries and may need to undertake extensive training of bank staff in carrying out their responsibilities under such rules.

92. Assistance to the private sector. Full application of the polluter pays principle and a fully competitive market would result in no government financial assistance to the private sector at less than commercial terms. However, such conditions are not likely to exist for some time. Even so, subsidies to the private sector (or to the remaining state enterprises) for environmental protection must be approached very cautiously and selectively. The case for subsidy may exist where: the problem is clearly the result of past neglect by the Government; some subsidy is judged necessary to put all competitors on an equal footing; the technology is unproven or experimental; or, other overriding reasons of public policy. Such subsidies should be phased out as quickly as possible.

The poor financial condition of an enterprise should not by itself be grounds for subsidizing pollution control; indeed, such enterprises are likely to fail anyway and the investment would be wasted. Funding of industrial environmental audits may be an appropriate form of government assistance in the early stages of restructuring, provided that the viability of the enterprise appears secure. Such audits or reviews, which could well be linked to similar actions directed at energy conservation, would examine the whole manufacturing process to identify opportunities to reduce waste and pollution by: better managerial control; improved maintenance; recycling of wastes into the production process; and, as a last resort, "end of pipe" treatment of effluents.

93. Role of institutes. In Czechoslovakia, technical work required by government departments is normally performed by specialized technical institutes attached to each ministry. Such work ranges from research to planning to design to construction supervision. While the basic distinction between administrative and technical functions will still be appropriate under a market economy, the need to retain the latter in the public sector will diminish. In other words, the institutes will probably shrink in size and number, focussing on research and planning, while private sector consulting firms (perhaps initially formed from parts of institutes) will increasingly take over design and construction work. Studies are needed to ensure that this occurs in the most efficient way in the environment (and other) sectors.

94. Non-governmental Organizations. The role of NGOs in drawing attention to the extent of environmental degradation under the old regime is fully acknowledged. They should continue to have that advocacy role even if that makes life uncomfortable for government officials. However, there are now other ways in which NGOs can supplement official programs, especially in public education, in participating in plant siting and other environmental assessment issues for new projects, in resolving "not in my backyard" impasses for facilities like toxic waste incinerators or nuclear power stations, in facilitating projects involving resettlement and the like. The extent to which the government should or should not support NGOs is a difficult question. Some - particularly advocacy groups - will refuse such support so as not to compromise their independence. Where groups undertake programs (such as public education) on behalf of the Government they should be compensated through contractual arrangements. This leaves the question of programmatic support to NGOs. This may be appropriate at an early stage to ensure the survival of fledgling organizations but making such arrangements permanent would probably hinder the evolution of a truly non-governmental movement.

Project Implementation

95. Project selection criteria. Within the broad limits set by budget allocations to particular programs, selection of the individual projects to be funded in a given year still need to be made. Ideally, this should be done through a comparison of costs and benefits but monetary estimates of benefits are rarely available in this field. A more feasible approach may be to rank projects by their reduction in risk to human health (relative risk times the number of people at risk) but this is at present only possible when the risks are of similar kinds, for example, comparing two different carcinogens. Such a process also leaves out ecological damage. For projects with benefits that are strictly

comparable, for example, alternatives for reducing SO₂ emissions, a simple cost-effectiveness criterion may suffice. In addition to objective health-related criteria, a number of other criteria, including economic impacts, feasibility of achieving near-term improvements, political visibility, and public support for a project (particularly as expressed by willingness to pay), should also be considered (paras 104-105).

96. Environmental assessment. While procedures for assessing the potential environmental impacts of new projects already exist in Czechoslovakia, they are inadequate and weakly enforced. A policy statement from the Federal and Republic Governments is needed, requiring a screening of all new investments in the public or private sector (including military projects) for their potential impact. For high-impact projects, a formal environmental assessment (EA) would be required to identify and quantify possible impacts, to guide siting decisions and to design mitigation measures to minimize such effects. The EA process should provide for input from other government departments, NGOs and affected populations. The EA report should be publicly available and its approval should be a condition for issuance of the building permit or operating license of the facility concerned. EA procedures will therefore need to include provision for the role of local governments. The federal and republican environment ministries will need to establish well-staffed units to monitor the EA process.

97. Procurement. The change to a competitive market economy will allow public agencies to procure through competitive bidding. International experience shows that this is usually the most efficient and economic way of purchasing. However, this change will require considerable effort in the preparation of bidding documents, evaluation of tenders, arbitration of disputed awards, and enforcement of specifications and other contract conditions. During the transition period, competition from foreign suppliers will be important in preventing excessive pricing from domestic monopolies.

Human Resources

98. By its nature, environment is a multi-sectoral activity and therefore requires a broad range of disciplines for its management. Chemists are needed for monitoring work, environmental (sanitary) engineers for water and sewerage systems, hydrogeologists for groundwater pollution, chemical engineers for industrial pollution control, agronomists, entomologists and toxicologists for integrated pest management, agricultural engineers for erosion control, foresters for forest management, ecologists for wildlife management, epidemiologists for measuring health impacts, lawyers for drafting and enforcing legislation, educationists for promoting public awareness, to name only the major categories. Czechoslovakia is fortunate in having well-trained specialists in all these areas. While detailed surveys are needed to determine whether sufficient numbers of the various disciplines are being produced to meet foreseeable needs in the public and private sectors, the general impression is that the situation is reasonably under control and the ministries report no major difficulties in recruiting staff. However, government staff lack experience in working in a fully functioning and experienced environmental agency and may not have been exposed to recent technological and managerial developments. Enterprise staff are generally knowledgeable about monitoring and pollution control techniques but are unused to implementing programs to meet compliance deadlines and are not

experienced in conducting environmental audits or identifying and taking advantage of opportunities for low-cost environmental improvement. Neither ministry nor enterprise staffs have much experience in economic and financial analysis in a market economy context.

99. Most staff of environmental ministries and of enterprises therefore require additional training both in the administrative aspects of their work and in their technical specialties. The former should be addressed by in-house seminars; the latter will require a variety of approaches - national workshops with invited lecturers from other countries; training of staff in foreign languages (English, German) so that they can keep abreast of the literature; dissemination of foreign technical journals; international study tours; attendance at international conferences and workshops; and internships with foreign environmental agencies. The latter could be part of a twinning arrangement with an outside agency involving staff exchanges, dissemination of technical information and special training courses. Enterprise and ministry staff also will require training in the emerging regulatory climate (including regulatory law) and in developing cost-effective solutions.

100. Managing a multi-disciplinary staff poses special challenges. This report recommends that a course in environmental administration at the Masters level be developed at at least one leading university. Such a course would give aspiring managers a working knowledge of the various technical specialties involved in environmental protection, as well as policy and administrative issues. A useful approach would be to "twin" each participating university with a Western counterpart with long experience in environmental management curricula. It is further recommended that each environmental ministry develop a comprehensive staff development plan that identifies training needs, sources of expertise and funding and a time schedule that accelerates staff development without removing too many key people from their work at the same time. Such training plans could also provide for the staff of enterprises and NGOs. These plans will need to be developed in close cooperation with existing educational and training bodies and should include provision for training of trainers.

International Relations and Aid Coordination

101. Each of the three ministries has an international relations department with a heavy and increasing workload related to liaison with foreign visitors, translation, interpretation and the like. Some of these staff also work on Czechoslovakia's participation in international forums and environmental conventions. They are not equipped, however, to set policy on external assistance or to analyze the many offers of assistance proposed by multilateral and bilateral donors, foundations, consultants and manufacturing firms. Some of these offers could potentially be very valuable to the country; others may be worthless.

102. Recognizing this problem, the EC's PHARE-I package includes assistance in setting up a Programme Implementation Unit (PIU) within the FCE. While created primarily to ensure the sound implementation of the EC program, the PIU is also intended to be the nucleus of an aid coordination unit at the federal level. Initially, it will have three expatriate and four to six local staff, reporting to the Deputy Minister. This report recommends that the PIU be the

focus for coordinating all foreign assistance in environment. To do this, it should: have access to all environmental data and reports (paras. 84-88 on the environmental information system); maintain a register of all programs and projects at the federal, republican and local levels for which foreign assistance is sought; be informed of the plans and priorities of all potential donors; maintain an inventory of foreign experts and equipment suppliers; and, facilitate the matching of funding sources and projects. Among these tasks, perhaps the most important is the establishment of the register of projects, using a format which clearly conveys the essential features of the proposal. This alone will greatly facilitate decision-making on the part of donors.

103. This leaves some important aid coordination roles to be performed at the republic level. One is the capacity to analyze and scrutinize offers of assistance both from a technical as well as a financial point of view, to establish their value to the ministry and to compare alternative approaches. Another is to establish procurement procedures and standard documents within the ministry in accordance with international practice (for goods, works and services), with appropriate variations to suit the requirements of particular donors. A third role is to act as a channel of communication for projects which are implemented at the regional or local level. In this regard, the Governments intend to set up republic-level program implementation units (RPIUs) at an early stage and staffed with a small number of high-level technical and procurement specialists. The RPIUs would also draw upon specialists throughout Czechoslovakia for particular analyses.

C. Mitigation Priorities

Criteria for Setting Priorities

104. There are a number of criteria which can be used to help set priorities for action. One approach (explained in detail in Annex A) is to use risk to human populations and ecosystems as a guiding principle, using the following risk-related characteristics:

- a) The toxicity of the pollutant to people or to ecosystems, the type of effect that is caused, and the severity of the effect.
- b) Whether or not particularly sensitive human populations such as asthmatics, young children, or pregnant women are at risk, and whether particularly sensitive components of an ecosystem, such as an endangered species, are at risk.
- c) The degree to which the effect is reversible, and the time-scale in which the effect can be reversed.
- d) The size of the population exposed, i.e., the degree to which the pollutant is ubiquitous in the environment. Examples of apparently ubiquitous pollutants are PCBs, heavy metals, and chlorinated pesticides.
- e) The degree to which the problem is local or regional.

- f) The degree to which multiple sources contribute to exposure and body burden. For example, heavy metals may reach humans through the air, water and food, contributing to an overall exposure that may present a significant risk.
- g) The degree to which the pollutant accumulates in the human body or in other parts of the biosphere.

105. Other, non-risk based, criteria should also be considered. These criteria include:

- a) Economic efficiency and efficacy in seeking least cost solutions for pollution abatement;
- b) public support and political visibility;
- c) willingness to pay;
- d) time frame for action (the ability to achieve tangible near-term environmental improvements);
- e) economic impact of the environmental degradation; and
- f) technical feasibility of control.

Priorities for Czechoslovakia

106. With these criteria in mind, and assuming that the national industrial and energy policies have been developed to a point such that the economic viability of a particular plant or facility can be determined, analysis of presently available data (Chapter II) suggests the following priorities for Czechoslovakia:

- a) Because of the ubiquitous nature of the exposure, the toxicity of the pollutants that have been found, and the nature of the effects that are caused, the primary focus will be on air pollution and the contamination of food, with a secondary focus on water and waste issues.
- b) For similar reasons, the primary focus will be on human health effects, with secondary focus on ecological effects.
- c) In the near term (0-5 years), a number of activities need to be started in order to ensure early reduction of risk, as well as to lay the foundations for future activities. These immediate activities include:
 - low cost, low technology pollution control (good housekeeping) where feasible;
 - installation of pollution control technologies at carefully selected facilities;

- development of monitoring capabilities and the establishment of networks to obtain information about pollutants, particularly toxic pollutants in the environment;
 - development of information and data bases to assimilate and integrate toxicity and environmental information and data;
 - research to better define the effects of pollution, and the relation of pollutants with health and ecological effects.
- d) A process should be established for assessing risks that result from exposure to pollutants in the environment. Such a process can be used:
- to differentiate among the risks posed by different pollutants;
 - as a screening tool to help set priorities for action;
 - to understand the risk reduction component of different regulatory and non-regulatory approaches;
 - to assess the relative risks of different geographical sites, such as hazardous waste sites;
 - to provide a basis for comparative risk assessments.
- e) General environmental monitoring should be largely risk driven in order to develop the information necessary for risk assessments. Whenever new or expanded monitoring networks are created, the goals for the data collection should be explicitly stated. Monitoring methods need to be brought up to the state-of-the-art in other countries. Methods need to be standardized both between and within the two republics. Methods for compliance monitoring, enforcement monitoring, and stack testing are well developed internationally. A technology transfer program should be established to bring such methods to Czechoslovakia. An effort should be mounted to develop a plan for the collection and analysis of monitoring data that has been obtained in the past, and for information about food ingestion and other human activity patterns that are necessary for an exposure assessment to be carried out.
- f) Close links need to be forged between data and information systems and any new monitoring systems that are to be established.

Specific Priorities

107. A framework for estimating multi-media exposure should be developed, focussing on contaminants which are known to be derived from several sources (e.g., lead). A research strategy to underpin pollution control efforts, especially in risk assessments, should also be put in place. Nevertheless, there is a great deal that can be done through media-specific approaches, as outlined below.

108. Air pollution. The strategy for reducing SO₂ and particulate emissions should give priority to large sources with substantial remaining life located in pollution "black spots", such as Northern Bohemia. This would suggest power stations such as Prunerov and Tusimice, as well as some captive power plants and

smelters (where economically viable). Studies are needed to develop the optimal sequence. Within each "black spot", plans must be developed to reduce peak concentrations (which typically arise during winter inversions); such plans should consider alternative, cleaner fuels, remote generation and industrial shutdowns. For other pollutants, such as organics and heavy metals, the REZZO system should be used to identify major sources and models developed for assessing human exposure to such sources (e.g., Arsenic at Novaki) along the lines of Annex A.

109. For Prague and other major cities, home heating is a major source of SO₂, NO_x and particulates; such cities will require the development of strategic plans based on economic and environmental comparison of alternatives, such as lignite briquettes, district heating (through co-generation) and gas reticulation, and incorporating district by district analysis of problems and priorities. The contribution of small industrial facilities, hazardous and other landfills to air pollution needs more study. Air pollution from motor vehicles is another area where more analysis is needed, leading to strategies for reducing lead, as well as SO₂ and smog-forming agents. Such strategies are likely to involve increasing the availability of unleaded petrol, requiring new vehicles to operate on unleaded fuel with catalytic convertors to reduce gaseous pollutants, pilot programs to retrofit older vehicles (which will form the bulk of the fleet for many years) and refinery investments to reduce the sulphur content of fuels. Given the potentially high cost of such a program, studies must emphasize cost-effectiveness and geographical priorities. At the same time public transit systems should be maintained and upgraded to provide an attractive alternative to private cars.

110. Food contamination. While the risks from food contamination in Czechoslovakia have not been extensively analyzed nor have they been widely publicized, available data suggests that exposure through the food chain - especially to heavy metals and chlorinated organics, such as PCBs and pesticides - is likely to be a major source of health impacts. An immediate priority is to step up monitoring and analytical efforts to compare these risks with other pollution sources, to trace the paths by which such contaminants enter the food chain and to develop policies and programs to remove them.

111. Water pollution. Given the importance of industrial facilities as sources of toxic contaminants, priority should be given to their mitigation provided that the enterprise is likely to survive restructuring. Regulations and programs should be written to facilitate treatment of concentrated waste streams before dilution. The large ongoing program of municipal waste water collection treatment should continue, with emphasis on accelerating the completion of current projects. Pre-treatment of industrial wastes entering public sewer systems should become mandatory. Despite the continuing large unmet need for sewage treatment, the rate of starting new projects should be moderated in light of the many emerging priority areas. The type and level of treatment should be based on case by case analysis, taking into account the assimilative capacity of the receiving water, the proximity of downstream users and the like. For environmentally sensitive locations, tertiary treatment (including, for example, de-nitrification) may be indicated; in most cases, secondary treatment is likely to be needed. For each river basin (watershed) (para. 78), a water quality management plan should be prepared, incorporating preventive measures in

agriculture and forestry as well as mitigation of upstream urban and industrial pollution sources. An important element of such plans should be measures to limit groundwater pollution, an area still requiring considerable diagnostic work. The contribution of mine tailings and ash deposits, as well as industrial waste piles, to surface and groundwater pollution also needs analysis and the development of treatment plans.

112. Wastes. Available inventories on current production of toxic and hazardous wastes (including the contribution of households and small industrial facilities) need to be made more complete and cost-effective methods of storage, transport and safe disposal developed and codified in regulations. Industrial environmental audits should indicate methods of reducing the production of toxic wastes through improved housekeeping and recycling. Demonstration projects may be appropriate. For certain wastes, especially liquid organics (such as PCBs), central incineration facilities will be needed. If possible, such facilities should operate on a commercial basis, possibly in the private sector.

113. While the problems of past toxic waste dumpsites are generally less urgent than the need to deal with current production, some aspects of existing dumps cannot be neglected. An immediate priority is to prepare emergency response and evacuation plans for areas around potentially explosive or eruptive hazardous waste sites, such as Chabarovice. All known sites should be screened to estimate their relative risks to human populations, taking into account location, proximity to settlements, nature of the contaminants (if known), geology, plume size and direction. For high risk sites, consideration should be given to containment or in situ treatment, using mobile incinerators where appropriate. It must be recognized that a program to completely deal with existing toxic waste dumps will be rather long-term and very expensive.

114. Nuclear Safety. There are eight 440 MW nuclear reactors in Czechoslovakia, four in Bohunice and four at Dukovany. Two units each were commissioned at Bohunice in 1979-1981 and 1985-1986, respectively, while all four of the units at Dukovany were commissioned during 1985-1987. Two of the units at Bohunice are presently shut down, and may be decommissioned in 1995. In addition, there are two 440 MW plants under construction at Mochovce, and two 1000 MW plants under construction at Temelin.

115. There is also a reactor at Bohunice (known as the A-1 reactor) which began operations in late 1972, but has been permanently shut down since 1979 because of two accidents in 1976 and 1977. The accidents included a partial core meltdown which caused radioactivity to spread inside the building. Thus far, attempts to clean-up the radioactive contamination have had limited success, and there is still no well prepared plan for decommissioning the A-1 unit. International assistance to prepare such a plan will be required since in addition to the spent fuel inside the unit, about 16,000 tons of solid radioactive waste is expected from the dismantling of equipment in the A-1 unit.

116. The most immediate short-term problems for nuclear power plants pertain to radiological monitoring and safety management which are required on a 24-hour basis. Present safety management practices are inadequate. In addition, an evaluation of the on-site storage capacity for spent fuel is also urgently needed, as are plans for the immediate reduction of liquid wastes and emergency

plans in the event of an accident. A team of international experts should be put together to draft comprehensive strategies for improving monitoring and safety management at Czechoslovakia's nuclear units, and to assess the options for increasing storage capacity of spent-fuel.

117. The most important long-term problems are associated with the storage and disposal of spent fuel from the A-1 reactor in Bohunice, and from nuclear units presently in operation or under construction. In the past, the Soviet Union agreed to accept nuclear wastes from Czechoslovakia once they were sufficiently cooled down. However, this practice stopped in 1990 because of a substantial increase in the disposal charge assessed by the Soviets. Moreover, any arrangements to ship nuclear wastes to the Soviet Union are tenuous because of the present changes in Soviet government which cloud all bilateral agreements. Thus, a long-term plan for safe disposal of spent fuel at all nuclear power plants for at least 30 years is necessary.

118. Nature conservation. More comprehensive policies need to be developed at federal and republic level for a more scientific approach to nature conservation, incorporating measures for the conservation of endangered species and habitats, as well as giving recognition to the recreational value of conservation areas. The ecological role of wetlands, for example, deserves greater recognition and the few remaining areas need protected status. A review should be made of the size, location and status of all protected areas and potential areas including the former "no man's land" strips along the German and Austrian borders (which may be valuable both in their own right for their quasi-natural habitats and also as corridors between other protected areas). Such a review might suggest a different pattern of areas to meet conservation and recreational objectives. Following this, park management policies will need to be realigned with emerging scientific priorities. The revenue generation potential of wildlife, particularly from international tourism, should be realized through realistic entrance fees and hunting fees.

119. Environmental objectives need specific recognition in the revision of agricultural laws. Amongst other things, better regulations for the control of fertilizer and pesticide runoff, to reduce soil erosion and to encourage beneficial species are needed. "Land reclamation" should be stepped up in mined areas but eliminated in steep or wetland areas. Forestry policies need revision to give greater recognition to the dangers of monoculture with exotic species and to institute cultivation practices which minimize soil erosion. Restoration of aquatic environments should be a specific objective of river basin clean-up plans (para. 111).

120. Monitoring. While monitoring systems undoubtedly need to be expanded both in quantity and in quality, such additions need to be made very selectively in accordance with risk assessment needs. There is a considerable need for technology transfer from Western countries in respect of enforcement and compliance monitoring methods, as well as stack emissions monitoring. State-of-the-art methods are also needed for toxic chemicals (such as chlorinated organics and heavy metals). Monitoring needs to be widened to include food ingestion studies. Better analysis of past monitoring data could also yield valuable information.

D. Financing and Investments

121. Principles of financing. The adoption of the polluter pays principle (PPP) and user pays principle (UPP) in Czechoslovakia implies that polluters and users will be brought to bear the cost of pollution and remediation. The structure of incentives to producers and consumers will therefore have to be altered so as to internalize externalities, implying a substantial increase in the level of charges, fines and fees. The primary purpose of such measures is to induce changes towards environmentally sound behavior, while at the same time collecting revenues to be used to finance environmental investments.

122. The emphasis on changing behavior also highlights the importance of rapid movement to private ownership and deregulation, which will permit producers to effect choices and thereby limit the need for public financing. Nevertheless, market mechanisms alone will not be sufficient to alter behavior, and must be coupled with an effective monitoring, inspection and enforcement structure, especially during the transition period.

123. The burden of investment financing. Producers and consumers will respond to the incentives created by the new price structure including the new pollution charges, fines and fees, through greater conservation and increasing energy and material use efficiency, and by investing in pollution abatement up to the point where the cost of abatement is equal to the cost of pollution as internalized by charges, fines and fees. The burden of investment to correct currently generated pollution is thus transferred to the producers, relieving the public sector of financial obligation.

124. Remedial action of past pollution on the other hand will continue to be largely borne by the public sector. Such investments would be financed through budgetary support, either directly from general revenue (from the Federal Budget or as a transfer to Republic budgets), or, from earmarked resources (channelled through the Environmental Funds). Resources available to remedy sites of past pollution could be further augmented by any broad-based national environmental tax (hydrocarbon, chemical industry, etc. see para. 66).

125. Timing and priorities. Czechoslovakia's macro-economic price and budget reforms and industrial restructuring and privatization program needs to play out during the transition before the bulk of the major, costly investment program is undertaken. These macroeconomic reforms will undoubtedly result in substantial realignments in fundamental supply and demand, including short-run contractions in certain sectors, such as the metallurgy and mining sectors. Producers and consumers response to the new price structure and the ensuing shifts in demand and supply will lead to greater conservation and increased efficiency in energy and material use and ipso facto lower pollution levels. Furthermore, movement to appropriate price policy--where the absolute and relative level of prices correctly reflects life-cycle long-run marginal costs--may result in changes in rank-order of priorities and in the levels of investments required. When for instance, correct pricing policy for energy is fully implemented, shifts in demand may indicate no growth (or even a decline) in energy supply needs, and future investments in the energy sector may well shift away from brown coal and nuclear towards natural gas and hard coal.

126. During the transition period therefore, investments must be very carefully selected in view of the substantial cost of the restructuring process the economy will have to undergo. In the past Czechoslovakia has invested less than 1% of GDP in addressing the causes of environmental degradation (see para. 52). Some catching up is therefore in order. If the iron and steel sector is an example, only 3-4 percent of capital costs are used for environmental protection as compared with 12-15 percent of capital costs in Western industrialized countries (See Volume 2). The total cost of restructuring of the iron and steel sector alone, including remedial investments but excluding the added operating and maintenance costs, can be estimated at about US\$150-300 million; and when other metals are included could be as much as US\$500 million. Similar figures have been reported for other sectors. Similarly, direct investments in air pollution retrofit (i.e., not including investments for monitoring) is likely to be in the many hundreds of US\$ millions. The overall cost is therefore likely to be substantial.

127. Great care must therefore be taken to assess the optimal location and timing of the sectoral investment. For instance, if the primary air pollution problem is not one of ambient but of point pollution during only a limited period of the year, measures other than heavy FGD investments, such as stockpiling of cleaner fuels for use during emergency, could be envisaged.

128. The above raises the following set of interrelated issues as regards setting of priorities: first, how will priorities be set? While most of the hot-spots are well known, in what order these should be addressed, however, is not resolved. Use of risk assessment, and environmental and economic audits for the sector and the industry etc. can facilitate ranking of problems¹². Secondly, the question as to by whom such priorities should be set also needs clarification. Decentralized decision-making would favor adoption of priorities that are consistent with local environmental conditions as well as with the ability of the local economy to implement expenditures to improve environmental conditions. Federal and Republican resources can be used on the one hand, co-finance local projects such as those projects with externalities not captured by the local authority, to influence choices of scale and technology, etc.; and, on the other hand, to attend to "orphan" projects such as abandoned toxic/hazardous waste sites.

129. Privatization and restructuring will also facilitate the undertaking of environmental investments. Authorities should however desist from reducing environmental standards as a means of inducing private ownership/equity, and use other vehicles such as fiscal (e.g., tax credits, deferred fines, investments in lieu of equity) and legal instruments (e.g., absolving new owners of past pollution liability) to ensure that long-term viability of privatization and cash infusion of otherwise viable plant is not compromised. For if new owners are

¹² For more detail on Risk Assessment, see Annex A. It should also be noted that environmental audits can serve as an effective vehicle to identify potential gains that can be internalized by industry. However, in light of the probabilistic nature of such gains, it might be desirable for the public sector to subsidize environmental audits.

held morally and pecuniarily responsible for past pollution this will create more "orphans".

130. Before heavy investments start, for example in the water sector or at the municipal level (solid wastes), sector policies with clearly defined priorities, pricing, financing mechanisms, ownership and institutional issues must be addressed. Air pollution abatement by industry or the energy sector could be foreseen only for economically viable enterprises or energy plants. But in general, it must be stated that the short-term priorities for the investments would be those that reduce or eliminate pollution related health problems for which there is clear empirical evidence.

131. Privatization can result in environmental investment not only by industrial or other private waste generators but also by environmental service providers that perceive a market for their services that is sufficient to warrant their investment. In many cases, such investment will be tied to the progress of standards-setting and enforcement. For example, as standards for disposition of hazardous wastes are tightened and as waste generators perceive more effective enforcement of such standards, demand will increase for hazardous waste treatment or recovery and secure disposal of the treated residues. In response to this increased market demand, hazardous waste treatment firms can be expected to make investments in treatment and disposal facilities, presuming they find the country's investment climate satisfactory. Other examples of potential private environmental services investment include laboratories to analyze wastes, air or water monitoring services, non-hazardous waste collection and disposal, industrial water pretreatment, and potentially water supply and wastewater treatment. Government policies can and will influence the pace and direction of such investment. Examples include not only standard-setting and enforcement but licensing of the facilities themselves, whether there is free competition or a system of franchise-type monopolies (for example, a municipal water supply or wastewater treatment utility), the nature of price and quality controls for utility-type enterprises, and so forth.

132. For specific environmental activities, Republic Governments may not be prepared to experiment with private management/ownership without extensive additional information. In such cases, a possibly attractive approach would be to allow pilot demonstrations of private provision of services in a specific geographic location. For example, a Republic or lower-level jurisdiction could decide to test private solid waste collection or private wastewater treatment in a specific community. Such an approach would generate valuable insights and experience without committing the Government to go beyond the pilot tests.

Economic Feasibility

133. Environmental protection and remediation costs for Czechoslovakia can be expected to be in the order of US\$50-100 billion. Similar estimates for neighboring countries are respectively US\$100 billion for Poland, and US\$130 billion for former East Germany. Over half of these requirements are allocated to the water sector. These estimates refer solely to environmental investments and do not include the costs of industrial restructuring.

134. Domestic resources available for environmental expenditures in 1991 are programmed to be in the order of Kcs 8 billion (about US\$300 million) for the Czech Republic and Kcs 3 billion (about US\$110 million) for the Slovak Republic, or about 3 percent of the combined total budgets, including resources of the Republic Environment Funds^{13/14}. Environment Funds are projected to mobilize Kcs 1.9 and 0.7 billion in 1991 for the Czech and Slovak Republics, respectively. The availability of resources for environmental expenditures in 1992 will depend on the level of economic activity and, in the case of Funds, the level of charges and fines. It can be expected that over the next two years as industry contracts or is restructured the two major sources of revenue (public enterprise profit taxes and payroll taxes) will stagnate or even decline. Projected commitments to environmental investments are not likely however to much exceed the 1991 projected commitments of 3 percent of total resources.

135. It is therefore essential that the resources generated from pollution and user charges be increased through higher charges and stricter enforcement in the coming years in order to meet financial requirements of environmental protection. This will reduce the pressure on general budget financing, while at the same time shifting the financial burden on polluters and thus encouraging behavioral change. It should also be noted that, even if air pollution charges were immediately increased by on average about ten-fold as has been proposed, their impact on the cost of production, and thus on inflation, will be negligible.

136. Given the scarcity of domestic resources, even with increased revenue from pollution and user charges, adequate financing is unlikely to be available over the coming years as compared to the substantial investment requirements. Bringing Czechoslovakia's real ambient standards to publicly acceptable levels will, in the absence of additional financing, be significantly delayed. Improvement of quality of Czechoslovakia's environment can however be greatly accelerated by recourse to private and public external financing. In addition to financial means, external assistance could provide much needed management skills, technology, know-how, etc. Direct private investment is however likely to be limited during the transition period as the fundamental market-oriented institutional, legal, economic and financial instruments are recreated. For similar reasons, commercial private financing is also likely to be limited. Public external capital can therefore play an important role during the transition in easing the financial constraints and in commencing the environmental remediation process. External public financing on favorable loan terms, if judiciously used, will allow for improvements in environmental quality even during the transition, a period that will coincide with the amortization grace period of external public financing (typically of 3-5 years). Repayment of

¹³ By comparison, the average cost of meeting EC environmental standards of a 400MW coal fired power plant has been estimated at about US\$200 million.

¹⁴ This amount of about Kcs 11 billion represents about 1.5 percent of projected GDP, less than the 2 percent of GDP rule-of-thumb. By comparison, OECD member states spent approximately between 0.5 and 2.5 percent of their GDP on environmental protection.

the loans would correspond to the medium term when Czechoslovakia can be expected to have resumed its growth pattern. This would allow Czechoslovakia to overcome some of its most severe problems, especially those in the hot-spot areas. Economic benefits would thus occur in the short-term while the financial burden of repayment would be incurred at the time when incomes would be higher and therefore the willingness of the public to pay, much greater. Social and political factors, while hard to quantify, will certainly add to the short-term benefits of environmental remediation.

CHAPTER IV

Plan of Action

Priority of Action

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
<p><u>Macro-Economic Policy</u></p> <p>General</p>	<p>CSFR, CR & SR</p>	<p>Begin phaseout of subsidies on energy, water, raw materials and agricultural inputs and subsidies to resource-consuming enterprises.</p> <p>Continue exchange rate adjustment.</p>	<p>Continue phaseout.</p> <p>Institute privatization program for large enterprises.</p> <p>Develop policies to encourage foreign investment. Promote linkages between emerging foreign and domestic companies to provide environmental services.</p>	<p>Complete phaseout of subsidies.</p> <p>Maintain market exchange rate levels.</p>
<p><u>Sectoral Coordination</u></p> <p>General</p>	<p>FCE</p>	<p>Ensure environmental concerns recognized in design of new sector policies.</p>	<p>Review scope for taxation measures with fiscal and incentive benefits (e.g., coal or hydrocarbon taxes, differential product charges).</p> <p>Review and revise system of mining royalties.</p>	
<p>Environmental Audits</p>	<p>CR & SR</p>	<p>Develop list of major polluters.</p> <p>Screen enterprises for economic viability.</p> <p>Begin pilot program of industrial environmental audits, including training, in consultation with target sectors.</p> <p>Initiate studies to identify least-cost long-term mitigation measures.</p>	<p>Generalize program of industrial environmental audits.</p> <p>Expand training programs.</p> <p>Provide TA and training to develop private sector companies to conduct audits.</p> <p>Provide guidelines and training to enterprises in low-cost measures.</p>	<p>Develop training curriculum for environmental audits.</p>
<p>Inter-sectoral linkages</p>	<p>FCE, CME & SCE</p>	<p>Appointment of high-level liaison staff plus adviser on environment-energy linkages.</p> <p>Appointment of high-level liaison staff plus adviser on environment-industry linkages.</p>	<p>Strengthen links to other sectors such as agriculture, labor (occupational safety and health) and transportation.</p> <p>Identify and design projects to demonstrate innovative approaches and technologies.</p>	<p>Implement demonstration projects.</p>

P r i o r i t y o f A c t i o n

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
<u>Institutional Roles</u> General Local Government Air Quality Management Regions (AQMRs) Food Quality River Basin Boards	FCE, CME & SCE	Clearly specify Federal and Republic environmental responsibilities.	Establish unit in each ministry to identify research needs and to translate research findings (for example, on risk assessment) into policy and program recommendations. Review the need for an Environmental Policy Institute.	Establish Environmental Policy Institute, if justified.
	FCE, CME & SCE	Establish environmental economics policy analysis in each Ministry (part of PIU and RPIU)	Initiate studies jointly with other Ministries to assess environmental and natural resources impact of macro and sectoral policies and to recommend new policy approaches.	Continue studies and implement findings.
	CME & SCE	Policy statement on role of local government.	Establishment of environmental units in selected larger cities.	Expand the establishment of municipal environmental units and locally-managed utilities.
	CR & SR		Managerial strengthening of water, sewerage and solid waste organizations in selected cities, including financial planning.	
	CME & SCE	Policy statement on role of AQMRs Legislation on AQMRs (part of Air Quality Law).	Establishment of AQMR in Northern Bohemia.	Establishment of additional AQMRs.
	CME & SCE	Review adequacy of monitoring and inspection system for food quality. Policy statement on river basin boards. Legislation on river basin boards (part of Water Quality Law).	Strengthen food quality monitoring and inspection system. Restructuring of first river basin board (Hornad).	Restructuring of other river basin boards.

Priority of Action

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
Role of Institutes	CME & SCE		Review role of institutes. Begin restructuring/ privatization process.	
Role of NGOs	FCE, CME & SCE	Review role of NGOs. Develop policy for financial assistance to NGOs.		
Public Participation	FCE, CME & SCE	Review issues of public participation in developing policy, setting fees or standards, enforcement, and monitoring and evaluation.	Design and initiate appropriate public participation programs. Establish policy on public access to environmental information.	Build formal public participation processes into policy and standards development processes. Incorporate eco-parliament or other public participation models in design and test of regional environmental management entities.
Project Selection	CME & SCE	Develop project selection criteria.		
Environmental Assessment	CME & SCE	Establish EA regulations.	Establish organizational units to monitor EA process.	
Procurement	FCE, CME & SCE	Develop procurement rules and standard documents for public sector projects.		
<u>Legislation and Enforcement</u>				
Legislation	FCE, CME & SCE	Pass the new Environmental Law, involving provision for revised air, water and soil standards and revised pollution charges and penalties.	Pass new laws on air pollution, water pollution, hazardous waste and nature conservation.	

P r i o r i t y o f A c t i o n

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
Enforcement	FCE, CME & SCE	Initiate preparatory work, including training and education programs, for improved standards-setting, permitting and enforcement.	<p>For main emitters: develop interim air and water emission ceilings and compliance schedules, effective permitting systems, and fee and fine structures.</p> <p>Develop conflict resolution processes (inc. negot'ation, arbitration, admin. law, and access to judicial system).</p>	<p>For main emitters: full enforcement of applicable standards.</p> <p>For other emitters: implement interim air and water emission ceilings, effective permitting systems, and fee and fine structures.</p> <p>Conflict resolution processes in place and functioning.</p> <p>Demonstrate models to institute and enforce more stringent local and regional standards where appropriate.</p>
<u>Information Systems</u>				
General	FCE, CME & SCE	Complete conceptual design of comprehensive monitoring, information and dissemination system.	Implement priority modules.	Implement remaining modules.
Comparative risk	FCE	<p>Categorize environmental responsibility into program areas.</p> <p>Arrange existing data by program.</p>	Acquire international data bases and arrange by program category.	Identify management data gaps.
Risk Assessment	FCE	Identify regulatory priorities and information needs.	Commission data collection on regulatory priorities.	Systematize in-country hazard, dose and exposure information.
Compliance Information	CME & SCE	Target sources for compliance.	<p>Develop standards for monitoring and laboratory equipment.</p> <p>Acquire monitoring equipment.</p> <p>Ensure laboratory capability.</p>	Identify patterns of non-compliance.

P r i o r i t y o f A c t i o n

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
Research Information	FCE, CME & SCE		Review research priorities and information needs. Develop plan to rationalize research data systems and analytical/ laboratory needs.	Initiate comprehensive environmental research plan.
Public Information	FCE, CME & SCE	Design dissemination formats - newsletters, brochures, etc. Issue first series of public information documents. Establish policy on public access to detailed environmental monitoring data.	Publish yearbook of environmental data. Establish a technical journal in English/ German.	
<u>Role of the Private Sector</u>	CME & SCE	Develop criteria for determining when subsidies to the private sector are appropriate. Adopt an Environmental Code of Conduct for all large privatizations.	Monitor implementation of Code of Conduct.	
<u>Human Resources</u>	FCE, CME & SCE	Identify/assess opportunities for private provision of environmental services, including policy analysis and advice, as well as technical areas.	For priority areas, assess/select institutional options (competition, government contract or franchise, regulated public utility, etc.). Identify/initiate changes in legal and institutional framework, and begin efforts to attract desired private investment/operations. Establish a non-government unit for environmental economics policy analysis. Establish a facility to cofinance private sector environmental prefeasibility studies or project development in priority areas.	Fully functioning private sector operations in priority areas. Assess other private sector opportunities and initiate same process for any additional areas of desired private activity.
Staffing needs	FCE, CME & SCE	Survey staffing needs and draw up manpower development plans.	Collaborate with education system to provide sufficient entry-level staff.	

Priority of Action

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
In-service training	FCE, CME & SCE	<p>Identify categories of staff needing short-term training through in-house seminars, foreign language training, dissemination of foreign journals, international study tours, attendance at international conferences, etc.</p> <p>Identify categories of staff needing longer-term training through academic institutions or twinning arrangements with foreign environmental agencies.</p>	<p>Design a Master's Degree program in environmental administration.</p> <p>Develop comprehensive staff development plan.</p> <p>Provide training for trainers.</p> <p>Provide training opportunities for staff of enterprises and NGOs.</p>	Continue development of training programs.
<u>International relations</u>				
PIU	FCE	<p>Establish federal PIU with appropriate staff and foreign advisers.</p> <p>Develop list of projects for which external assistance is sought.</p>	<p>Expand role of PIU to accommodate needs of other donors and to assume aid coordination role.</p> <p>Establish inventory of programs, projects, experts and equipment suppliers.</p> <p>Maintain coordination with TFA Unit.</p> <p>Revise and expand project list.</p>	
RPIU	CME & SCE	<p>Define functions of RPIU.</p> <p>Establish RPIUs in both Republics.</p>	Strengthen RPIUs.	
Trans-Boundary Issues	FCE	Develop program for complying with trans-boundary agreements.	Ratify outstanding international agreements.	
	FCE & CME	Appoint working group to foster regional cooperation on transboundary air pollution, in particular with Poland and Germany.	Develop a cooperative plan of action.	Implement plan of action.

P r i o r i t y o f A c t i o n

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
Global Issues	FCE, CME & SCE	Appoint working groups to foster regional cooperation on transboundary water pollution, especially for the Labe (Elbe), Odra and Danube Basins.	Develop cooperative plans of action for one or two key basins.	Implement plans of action. Develop plans for other basins.
	CME & SCE	Intensify cooperative efforts to identify and address priority Republic cross-border environmental problems.		
	FCE	Commence studies of problems such as greenhouse gases, ozone depleting substances, pollution of international wastes and conservation of biodiversity.	Develop program to reduce emissions of greenhouse gases, including energy conservation and expansion of natural gas availability. Develop plan to introduce substitutes for ozone depleting substances.	Implement program Cease domestic production of ozone depleting substances. Pass legislation to outlaw such substances.
<u>Priority Setting</u>				
Criteria	CME & SCE	Develop policy statement with criteria for setting priorities.	Use adopted criteria to set program priorities.	Adjust priorities in the light of improved information. Develop programs for secondary priority issues.
<u>Mitigation Measures</u>				
General	FCE, CME & SCE	Initiate thorough assessment of alternative mitigation measures, balancing regulatory and market-based approaches.	Starting with highest priority areas, develop time-phased mitigation strategies combining market and regulatory approaches. Develop framework for estimating multi-media exposure. Propose measures for integration of environmental management.	Implement integrated approach.
Research	FCE, CME & SCE		Prepare proposal for a strategy for environmental research.	Develop and implement environmental research strategy.

Priority of Action

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
Air Pollution	CSFR, CR & SR	<p>Determine priorities for FGD.</p> <p>Undertake feasibility and design studies for priority FGD sites (Prunerov, Tusimice, etc.)</p> <p>Develop action plan for particulate control, followed by design studies.</p> <p>Upgrade pollution emergency plans, using a broader range of instruments.</p> <p>Inventory other major air pollution sources.</p> <p>Analyze sources of urban air pollution and develop least-cost strategy for reduction for one case.</p>	<p>Implement FGD and ESP investments at priority sites.</p> <p>Implement improved emergency planning in one region (e.g. Northern Bohemia).</p> <p>Develop least-cost investment plans for public sector sources and compliance plans for private sector.</p> <p>Implement strategy for first urban case.</p> <p>Analyze nature and extent of motor vehicle contribution to air pollution and develop control strategy.</p>	<p>Continue investment program.</p> <p>Extend planning to additional regions.</p> <p>Implement plans and monitor compliance.</p> <p>Develop and implement additional urban air quality plans.</p> <p>Implement motor vehicle air quality strategy.</p>
Food Contamination	CSFR, CR & SR	<p>Develop short-term monitoring and analytical program to assess risks and trace pathways.</p>	<p>Develop strategy for reducing food contamination to acceptable levels and commence implementation.</p>	<p>Continue implementation and monitoring.</p>

P r i o r i t y o f A c t i o n

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
Water Pollution	CR & SR	<p>Accelerate completion of ongoing municipal waste water treatment plants, with pre-treatment of industrial wastes.</p> <p>Review priorities for industrial waste water treatment based on relative risks, economic viability of enterprise and self-financing capability.</p>	<p>Develop program of new municipal waste water treatment projects based on relative risks, institutional capability and self-financing capability.</p> <p>Undertake study of potential for private sector management or ownership of water and sewerage systems.</p> <p>Revise design criteria for water and waste water treatment levels.</p> <p>Implement policy and technical measures to rationalize per capita water consumption levels.</p> <p>Continue support to industrial pollution control through lines of credit.</p> <p>Draw up first river basin water quality management plan, including non-point sources and groundwater issues.</p>	<p>Continue implementation.</p> <p>Develop demonstration cases for privatization.</p> <p>Continue implementation.</p> <p>Prepare additional river basin water quality management plans.</p>
Wastes - Hazardous	FCE, CME & SCE	<p>Upgrade inventories of current production of toxic and hazardous wastes and past dump sites, including screening for relative risks.</p> <p>Determine role of private sector in hazardous waste disposal.</p> <p>Prepare emergency response and evacuation plans for extremely hazardous sites.</p>	<p>Issue regulations on storage, transport and disposal of hazardous wastes.</p> <p>Institute hazardous waste information system.</p> <p>Specify and procure demonstration mobile hazardous waste disposal facility.</p> <p>Design and begin construction of first central disposal facilities.</p>	<p>Begin major effort to address past dumpsites.</p> <p>Develop long-term plan for safe disposal of nuclear wastes.</p>
Wastes - Nuclear		<p>Improve radiological monitoring, safety management, and emergency planning.</p>	<p>Develop long-term program for storage and disposal of spent fuel.</p>	

Priority of Action

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
Wastes - Municipal	CME & SCE	Identify opportunities in at least three major urban centers for a comprehensive approach to solid waste collection and disposal, including recycling.	Develop project plans for three cities. Begin one demonstration scheme for innovative solid waste management. Assess potential private sector role in waste management.	Develop plans for additional cities. Implement initial set of comprehensive plans. Privatize waste services in selected locations.
Occupational Safety and Health	CSFR, CR & SR	Review needs for new legislation and regulation.	Initiate new regulations and compliance programs.	
<u>Natural Resources</u> Nature Conservation	FCE, CME & SCE	Develop a nature conservation policy which balances scientific, developmental and recreational objectives. Develop specific policies for endangered flora, fauna and habitats.	Revise listings of threatened and endangered species to include only native species truly threatened. Incorporate impacts on threatened species in EA procedures.	Consolidate responsibility at the Republic level for nature conservation under a single organization.
Protected Areas	CME & SCE		Review size, location and status of all protected areas, including border areas, assess threats to them from pollution and unmanaged development and develop a protected areas strategy. Instal system for monitoring ecological status and trends for the protected areas system.	Implement strategy, including managerial strengthening and tapping of revenue potential. Implement "integrated landscape studies" for Krivoklat, Trebon, Krknose, Palava and Jeseniky.
Aquatic Resources	CME & SCE	Develop coordinated Federal/ Republic policies for rivers, lakes and wetlands, including a "no net loss" policy for wetlands. Include aquatic resources in river basin plans.	Review adequacy of proposed new water quality standards from aquatic resources viewpoint.	

P r i o r i t y o f A c t i o n

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
Forestry	CR & SR	<p>Review forest management and reforestation policies to emphasize conservation of original forest species and soil and water conservation and propose amendments to the Forestry Act.</p> <p>Establish a joint Federal/ Republic committee to harmonize policies and to deal with transboundary issues.</p>	<p>Review adequacy of proposed new air quality standards from forest management standpoint.</p> <p>Implement improved forest management practices, emphasizing no cost/ low cost measures.</p> <p>Introduce measures to promote privatization of forest resources under strict environmental controls and with realistic royalty payments.</p>	<p>Monitor results of improved forest management and air pollution reductions.</p>
Agriculture	CR & SR	<p>Incorporate environmental concerns in revised Agriculture Law, with emphasis on groundwater, surface water, biodiversity and endangered species.</p> <p>Develop policy on soil conservation.</p> <p>Develop training programs for newly privatized landowners, including environmentally friendly farming techniques.</p>	<p>Revise pesticide regulations to reflect impacts on flora and fauna, water quality and operator safety.</p> <p>Introduce regulations on fertilizer use and intensive animal production in line with Western European practice.</p> <p>Implement soil conservation policy.</p> <p>Introduce a credit program for farmers needing financial assistance in meeting new standards.</p> <p>Implement training programs.</p>	<p>Monitor impact of new regulations on water quality and biodiversity.</p>
Land Reclamation	CR & SR	<p>Discontinue programs for reclaiming marginal lands, especially wetlands, to compensate for land lost to urbanization.</p> <p>Undertake study for reclamation of mined lands in Northern Bohemia, emphasizing policy development, legal responsibilities and financing mechanisms.</p>	<p>Draft new legislation for land reclamation.</p> <p>Implement program of improved reclamation in Northern Bohemia.</p> <p>Undertake studies of other mining areas.</p>	
<u>Financial Instruments</u>				

P r i o r i t y o f A c t i o n

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
Pollution and User Charges	CME & SCE	<p>Increase air and water pollution charges and fines immediately following adoption of enabling and implementation legislation, and ensure such charges and fines are indexed to an industrial price index.</p> <p>Introduce waste charges indexed to an industrial price index upon adoption of enabling legislation.</p> <p>Undertake analysis to estimate (i) levels of pollution charges that would correspond to marginal abatement costs (MAC) by major sector required to attain the new interim standards, and (ii) the fiscal, inflationary, output and employment effect of implementation of charge levels that reflect MAC.</p> <p>Prepare a system of royalties and extraction licenses for natural resources.</p> <p>Transfer responsibility to set water user charges (Municipal tap water) charges to Republic authorities. Increase user charges to reflect operation and maintenance costs. Prepare a plan to phase-in full cost pricing.</p>	<p>Phase-in real increases in air and water pollution charges, in line with the analysis of MAC.</p> <p>Begin applying system of royalties or other payments for natural resource extraction (e.g., minerals or forest products).</p> <p>Phase-in real increases in user fees for water supply, wastewater treatment, and solid and hazardous waste collection and disposal to progressively cover full costs of such services.</p> <p>Make provision to further transfer responsibility to manage water supply and waste water treatment networks, including the authority to set prices and charges higher than Republic minima to pilot municipalities.</p>	<p>By end of period (3-5 years), achieve levels of (a) pollution charges where waste generators would prefer to prevent pollution rather than pay charges, (b) royalties which fully reflect environmental and other social costs of natural resource use, and (c) user fees which reflect long-run marginal costs of the services.</p> <p>Achieve self-management and self-financing at local level for a majority of water supply, sewerage and municipal solid waste systems.</p> <p>Undertake study of tradeable emission permits.</p> <p>Introduce private municipal services (e.g. solid waste, water network) in (a) pilot municipality(ies).</p>

Priority of Action

Subject	Responsibility	I - Immediate	II - Within One Year	III - Within Three Years
Strategy	CSFR, CME & SCE	<p>Review and strengthen framework for the collection and use of pollution and user charges.</p> <p>Identify (on a least cost basis) priority financing needs and current or potential sources of such financing including waste generators, environmental service firms, pollution charges as they are increased, etc.</p> <p>Establish Republic Environmental Funds.</p>	<p>Permit pilot River Basin Boards and AQMRs to: (i) retain revenues from pollution charges and fines; and (ii) set standards, charges and fines stricter than Republic minima.</p> <p>Establish time-phased priorities for Republic Environmental Fund expenditures.</p> <p>Assess opportunities for further decentralization of collection and expenditure of fees and charges.</p> <p>Introduce a tax on toxic wastes and production processes generating toxic wastes.</p> <p>Undertake study of feasibility and fiscal, monetary, output and employment effects of introducing additional instruments to: (i) change polluter behaviour (including for instance differential product charges -- motor oil; deposit schemes -- lead batteries; lower import surtaxes for select environmentally sound products -- catalytic converters; and (ii) raise revenue for environmental investments, including for instance, development bonds, fossil fuel tax etc.</p>	<p>Implement results of study.</p>
Budget	CSFR, CME & SCE	<p>Earmark revenues from pollution charges and fines to environmental expenditures.</p> <p>Develop criteria for setting priorities for supplemental Federal financing of investments in decentralised regions (RBB(s), AQMR(s), etc).</p>		<p>Within two years, start phaseout of general budgetary financing of environmental investments, with increasing reliance on the polluter and user pays principles.</p>

Risk Assessment

1. Despite the fact that risk assessment has become a subject that has been extensively discussed in recent years, many of the terms do not have 'standard' definitions. Currently, ecological risk assessment methods are being developed, but, in the past, risk assessments have been performed largely to estimate effects on humans. The following discussion and description of terms, therefore, focuses on human health risk assessments, although a parallel discussion would apply to assessments of ecological impacts.¹

Risk Assessment and Risk Management

2. Risk assessment is defined as the characterization of the potential adverse health effects of human exposures to environmental hazards. Risk assessments include several elements: description of the potential adverse health effects based on an evaluation of the epidemiologic, clinical, toxicologic, and environmental research; extrapolation from those results to predict the type and estimate the extent of health effects in humans under given conditions of exposure; judgments as to the number and characteristics of persons exposed at various intensities and durations; and summary judgments on the existence and overall magnitude of the public health problem. Risk assessment also includes characterization of the uncertainties inherent in the process of inferring risk.

3. The term "risk assessment" is often given narrower and broader meanings. For some, the term is synonymous with quantitative risk assessment and emphasizes reliance on numerical results. The definition used here includes quantification, but also includes qualitative expressions of risk. Quantitative estimates of risk are not always feasible, and in certain circumstances may not be desirable.

4. Risk management is the process of evaluating alternative regulatory and non-regulatory actions and selecting among them. Risk management, which is usually carried out by governmental agencies under various legislative mandates, is a decision-making process that entails consideration of political, social, economic, and engineering information with risk-related information to develop, analyze, and compare options and to select the appropriate response to a potential health hazard. The selection process necessarily requires the use of value judgments on such issues as the acceptability of risk and the reasonableness of the costs of control.

Steps in Risk Assessment

5. Risk assessment can be divided into four major steps: hazard identification, dose-response assessment, exposure assessment and risk characterization. A risk assessment might stop with the first step, hazard identification, if no adverse effect is found or if an agency elects to take action without further analysis, for reasons of policy or statutory mandate.

6. Of the four steps, hazard identification is the most easily recognized. It is defined as the process of determining whether exposure to an agent can

¹ Excerpted from "Risk Assessment in the Federal Government: Managing the Process"; National Academy Press, Washington, D.C., 1983.

cause an increase in the incidence of a health condition (cancer, birth defect, etc.). It involves characterizing the nature and strength of the evidence of causation, i.e., it answers the question: "Does the agent cause the adverse effect?".

7. Dose-response assessment is the process of characterizing the relation between the dose of an agent administered or received and the incidence of an adverse health effect in exposed populations and estimating the incidence of the effect as a function of human exposure to the agent. It take account of intensity of exposure, age pattern of exposure, and possibly other variables that might affect response such as sex, lifestyle, and other modifying factors. A dose response assessment often requires extrapolation from high to low dose and extrapolation from animals to humans. A dose-response assessment describes and justifies the methods of extrapolation used to predict incidence and characterizes the statistical and biologic uncertainties in these methods. It answers the question: "What is the relationship between dose and incidence in humans?".

8. Exposure assessment is the process of measuring or estimating the intensity, frequency, and duration of human exposures to an agent currently or previously present in the environment or of estimating hypothetical exposures that might arise from the release of new chemicals into the environment. In its most complete form, it describes the magnitude, duration, schedule, and route of exposure; the size, nature, and classes of the human populations exposed; and the uncertainties in all estimates. Exposure assessment is often used to identify feasible prospective control options and to predict the effects of available control technologies on exposure. It answers the question: "What exposures are currently experienced or anticipated under different conditions?".

9. Risk characterization is the process of estimating the incidence of a health effect under the various conditions of human exposure described in exposure assessment. It is performed by combining the exposure and dose-response assessments. The summary effects of the uncertainties in the preceding steps are described in this step. It answers the question: "What is the estimated incidence of the adverse effect in a given population?". The relationship among the four steps of risk assessment and between risk assessment and risk management are depicted in Figure 1.

