

# The Bottom Line

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Industry and the Environment  
in South Africa



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Edited by Lael Bethlehem & Michael Goldblatt

Industrial Strategy Project

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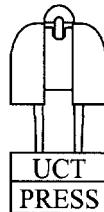
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*Edited by*  
*Lael Bethlehem*  
*and*  
*Michael Goldblatt*



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We were encouraged to conduct this research by Dr Tim Jackson and the Environmental Monitoring Group. Their earlier work showed that industrial strategy in South Africa had taken insufficient account of environmental issues, and this helped to catalyse our study.

The research process was informed by a trade union reference group. This group comprised Bhabhali Ka Maphikela Nhlapo (Construction and Allied Workers' Union), Mike Serobo (Post and Telecommunications Workers' Union), Sekoati Mokoena and Jerry Chiloane (South African Commercial Catering and Allied Workers' Union), Albert Moshaoi (South African Railway and Harbours Workers' Union), Paul Sehlabelo and Linda Mngadi (Paper Printing and Allied Workers' Union), Paul Matekane (National Education Health and Allied Workers' Union), Lance Veotte and Jerry Chaka (South African Municipal Workers' Union), John Wilimiec (Underground Officials' Association of South Africa) and Buti Msimang (National Council of Trade Unions). The reference group provided valuable insights derived from their daily experience.

We thank Pelelo Magane, who was seconded to the ISP from the Chemical Workers' Industrial Union. He conducted research on health, safety and environment issues and also coordinated the trade union reference group. We thank the CWIU for making Pelelo available.

Two workshops were held in the course of the research and these gave us an opportunity to discuss our findings with environmentalists, academics, business managers and government officials. We are grateful to all those who attended the workshops for their valuable input and to the members of the Industrial Environmental Forum, a network of companies concerned with promoting industrial environmental management.

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# Preface

The first phase of the Industrial Strategy Project commenced in 1992. The project has its origins in the Congress of South African Trade Unions' efforts to develop policy responses to the malaise afflicting South African manufacturing.

The final report on the first phase of the ISP was submitted in 1995. This comprised 11 sectoral studies and a synthesis volume that proposed an overall industrial strategy for South Africa.

The ISP is now in its second phase which comprises four research themes. One of these examines the relationship between industrial development and the environment, a second focuses on firm-level innovation, a third examines issues in human resource development, and a fourth is concerned with identifying mechanisms to strengthen manufacturing competitiveness at regional and local levels. The second phase of the ISP is funded by the Friedrich Ebert Stiftung, the Humanistisch Instituut Voor Ontwikkelingsamen-werking, the International Development Research Centre, and the Olof Palme International Centre.

This collection represents the fruits of our research on industry and environment. It examines environmental issues from an industrial policy perspective. The essays combine the insights of a multidisciplinary team, committed to the twin and intimately related imperatives of industrial development and environmental sustainability.

Our efforts represent a beginning and an important objective will have been served if this work is the catalyst for further research. Growing evidence of concern for these issues on the part of policymakers in the departments of Trade and Industry, Environmental Affairs and Tourism and Water Affairs and Forestry should act as a powerful incentive to the research community. The Congress of South African Trade Unions and several major corporations are also developing capacity in this area.

This work is intended to encourage policy debate. The chapters express the views of their respective authors and not necessarily those of the ISP.

**David Lewis**

*Director: Industrial Strategy Project*

**Lael Bethlehem**

*Research coordinator: labour, industry and environment research programme*

# Foreword

The economic policies and strategies of the South African government are deeply rooted in explicit commitments to the attainment of high levels of economic growth and social justice. We have never accepted the argument—still espoused in some circles—that purports to find conflict between economic growth and democracy, between economic growth and respect for the basic rights and requirements of workers, communities and the environment. Just as it is impossible to imagine material prosperity in the absence of high rates of economic growth, so is it equally impossible to imagine sustaining the conditions for economic progress in the context of policies that threaten the underlying social and material conditions for that growth: a productive workforce, cohesive communities and a healthy, well-functioning environment.

The essays in this volume reinforce this general approach. Concerned to explore the relationship between industrial growth and the environment, the authors clearly establish compatibility between material progress, on the one hand, and respect for the physical environment, on the other. Indeed, the argument goes further: it establishes that industrial strategies that fail to respect the environment will, at best, generate short-term growth, but will guarantee long-term stagnation. Increasingly, even in the short-term, environmentally destructive strategies and methods of production will fall foul of the minimum requirements of many of our most important trading partners.

There is much work that remains to be done in this area. Policymakers, investors, managers and unions all need to factor these key variables into their decision-making. The Industrial Strategy Project has taken an important first step in providing the basis for informed approaches to this vital and complex area.

**Alec Erwin**  
*Minister of Trade and Industry*

## Acronyms and abbreviations

CFC	chloro-fluorocarbon
CH <sub>4</sub>	methane
c/kwh	cents per kilowatt-hour
CO <sub>2</sub>	carbon dioxide
COSATU	Congress of South African Trade Unions
CSS	Central Statistical Service
CWIU	Chemical Workers' Industrial Union
DBSA	Development Bank of Southern Africa
FCCC	Framework Convention on Climate Change
GATT	General Agreement on Tariffs and Trade
GDP	gross domestic product
GWh	gigawatt-hour
IDRC	International Development Research Centre
IPCC	Intergovernmental Panel on Climate Change
ISO	International Standards Organisation
ISP	Industrial Strategy Project
MW	megawatts
NO <sub>x</sub>	nitrogen oxides
SARB	South African Reserve Bank
SMME	small, medium and micro-sized enterprise
SO <sub>x</sub>	sulphur oxides
SO <sub>2</sub>	sulphur dioxide
UNCTAD	United Nations Conference on Trade and Development

# Contributors

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## **Mark Butler**

Mark Butler is a senior researcher at the Community Agency for Social Inquiry. He has worked in a wide range of research fields, including political violence, out-of-school youth, adult basic education, development and environment. Most recently, Mark represented the non-governmental sector on the drafting team of the Environment GreenPaper. Mark is active in the Environmental Justice Networking Forum.

## **Ann Coleman**

Ann Coleman graduated in 1985 with a BSc in Chemical Engineering and in 1994 with an MSc, both from the University of Cape Town. She is currently engaged in environmental consultancy work, which includes projects on waste management, with an emphasis on waste minimisation and cleaner production strategies.

## **Iain Currie**

Iain Currie BA Hons (Witwatersrand) MA LLB (Cape Town), Advocate of the Supreme Court of South Africa, is a lecturer at the Witwatersrand Law School. He acts as a part-time consultant to government departments, non-governmental organisations and the private sector on constitutional law, property and environmental law.

## **Bill Gibson**

Bill Gibson is a professor of economics at the University of Vermont, USA. He was awarded a doctorate from the University of California at Berkeley, and he has specialised in macro-models for developing countries. Bill has published numerous academic articles, including macro-models for South Africa, Nicaragua, Mexico and Bolivia. He has been a visiting professor at Berkeley and Notre Dame, and visiting researcher at the University of Durban-Westville and the Development Bank of Southern Africa.

## **Michael Goldblatt**

Michael Goldblatt is Programme Manager of the Environment and Development Programme at the Graduate School of Public and Development Management at the University of the Witwatersrand. He is currently completing a Masters degree in Geography and Environmental Studies at the University of Witwatersrand, and is involved in a number of environmental research projects in the fields of environmental economics and water resource management. He is a member of the drafting committee of the Integrated Pollution Control Policy.

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Peter Lazarus BA LLB (Witwatersrand) is an advocate of the Supreme Court of South Africa, and specialises in environmental and water law. He is also a part-time lecturer in environmental law at the Wits Law School. During 1995 and 1996 he was a member of the Water Law Reform Monitoring Panel appointed by the Minister of Water Affairs and Forestry to oversee the water law reform process.

### **Pelelo Magane**

Pelelo Magane is an organiser for the Chemical Workers' Industrial Union, where he has worked since 1986. He is currently a branch health, safety and environment coordinator. Pelelo serves on the board of the Group for Environmental Monitoring, and takes a keen interest in community environmental issues.

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# INTRODUCTION

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## Issues and perspectives

Lael Bethlehem and Michael Goldblatt

**S**outh Africa in the mid-1990s faces urgent questions: How to address the severe inequalities that developed under apartheid? How to build a stable democracy in the face of enormous unemployment and widespread poverty? How to adjust to the new context of declining tariffs, increased competition and fiscal restraint? How to develop the manufacturing sector in the face of declining mineral wealth? And how—although this question is less often asked—to address the environmental degradation that resulted from apartheid and ensure that the path of development is sustainable from an environmental point of view?

This book sets out to explore the place of the environment in South Africa's industrial development. The issues we confront are at the confluence of debates on industrial and environmental policy. In the South African context surprisingly little has been written on the environmental management of industry at a macro-level. Work has been done on the management of particular processes, on some of the legal issues, on pollution problems in certain sectors and on (real and imagined) conflicts between environment and development. But relatively little attention has been given to the environmental issues facing the industrial sector as a whole, and to the dilemmas facing policymakers in this regard. We set out to enrich this debate by focusing on the linkages between industry and environment.

In so doing we also want to address the linkages between trade unions and environmental issues. Some debate has taken place on the capacity of South African trade unions to engage in environmental struggles, and the appropriateness of them doing so. We explore this issue further and focus specifically on the linkages between environmental management and health and safety management, as well as the relationship between labour's economic concerns and environmental development.

This book is the result of a study on labour, industry and environment which was conducted by the Industrial Strategy Project (ISP). The idea for the study arose from earlier work done by the ISP on South African industry. In the early 1990s, the ISP began research on South African industry which resulted in the publication of eight sectoral studies and a synthesis volume tackling the generic and macro-issues in industrial policy. Much was learned during that research, including a conception of how to characterise South Africa's industrial development and how to begin to address problems, including the balance of payments constraint, low productivity growth, poor technological development and low

levels of human resource development. But what became clear during the research is that an analysis of South African industry was incomplete without an understanding of the environmental possibilities and constraints facing it. We, therefore, embarked on this study.

One of our assumptions in this study is the idea that industry is dependent both on natural resources and on the capacity of the environment to accommodate the waste which it generates. The sustained development of industry is, therefore, dependent on the continued existence of these source and sink functions of the natural environment. This analysis was the starting point for considering how industrial strategy could incorporate these concerns into its hitherto narrower focus on economic and industrial growth and development.

Beyond the industrial sector our economy and society as a whole is merely a subset of the larger world ecosystem. The sustainable management, and protection where necessary, of natural resources is, therefore, not only about sustaining the basis for production but also about sustaining our place in the world. The question of the intrinsic value of the existence of environmental resources is an issue which needs to be considered alongside debates about future industrial strategy, and has begun to be raised in this research project.

### **An environmental characterisation of the economy**

The South African economy has been analysed and critiqued in a number of ways: low productivity, poor international competitiveness, unequal distribution of income, overconcentration and other structural problems impeding sustained economic growth and human development. However, there has as yet been no overall analysis of the environmental sustainability of the economy. This is a source of concern—a rough and ready analysis of the economy points to some worrying structural problems in this regard.

From an environmental point of view one could say that three factors characterise the economy:

- it is highly reliant on a number of energy-intensive sectors dependent on low electricity prices;
- it has a set of old capital stock due to South Africa's relative absence from the world economy and low levels of foreign investment in the 1980s; and
- primary non-renewable resource extraction and associated industries, essentially mining and minerals processing, provide a major, albeit declining in parts, proportion of gross domestic product (GDP), exports and employment.

This characterisation is one that has been included in earlier industrial policy analyses, but what does it mean from a sustainable development perspective? Firstly, South Africa's coal-based electricity generation, in combination with high energy intensity, makes it the third-highest producer of greenhouse gases in the world relative to GDP (Worldwatch Institute 1996). South Africa's power stations are not fitted with desulphurisation or denitrification equipment, leading to high levels of sulphur dioxide ( $\text{SO}_2$ ) and nitrogen oxides ( $\text{NO}_x$ ) emissions which contribute to acidic deposition and health risks. At the same time Eskom has committed itself to becoming the world's lowest-cost electricity producer, with many large-scale industries dependent on a continued supply of cheap electricity.

Old capital stock means that clean technology innovations are not widespread throughout the industrial economy. Production processes with low pollution per output levels and high materials and energy efficiency are not widespread in the manufacturing sector, nor are facilities for waste exchange and recycling. Our levels of waste production are very high, particularly in those same primary and secondary sectors on which the economy is so dependent: gold and coalmining, and minerals and metals processing, as well as in certain other key manufacturing sectors such as chemicals production. Apart from waste production the mining sector generates enormous environmental impacts, particularly in certain regions of the country. Air pollution, destruction of arable land and natural areas, water pollution and huge health and safety impacts are all associated with this sector of the economy.

At the same time South Africa is dependent on renewable resource sector production for employment and subsistence farming. This makes the country dependent on soil and water quality and on sustainable natural resource management, and highly vulnerable to shocks to these resources or to declines in their quality.

Associated with these structural problems are a weak regulatory framework for environmental control and management, with inadequately resourced and empowered environmental regulatory institutions. There is also evidence of weak social and economic pressures for a greater emphasis on environmentally sustainable development. There seem to be weak market incentives for improved environmental performance, with relatively low levels of consumer awareness and activism. Civil society and trade union actions have had some significant impacts, but generally on a very localised scale. And during the apartheid years, South Africa's relative isolation temporarily shielded the industrial sector from some of the international pressures for environmental improvement.

Although the details of South Africa's environmental problems are specific to our country, the problems are not unique. The challenge of Agenda 21, the manifesto arising from the United Nations Conference on Environment and Development (1992), "to improve production systems through technologies and processes that utilize resources more efficiently and at the same time produce less wastes—achieving more with less...", is a challenge facing the world's developed *and* developing economies.

## The challenge of sustainable development

For a number of decades there have been warnings that the scale of human activity could exceed the capacity of the earth's natural systems to sustain them. These warnings initially came from academics and researchers, but now are being raised by far broader sectors of our society. As Postel (1994) points out, this may well be because signs of environmental constraints are now pervasive. In South Africa grasslands have been overgrazed and fisheries overexploited. Water resources are overstretched and polluted, and South Africans are having to extend further and further afield for future supplies. Similar problems apply to our soil resources and to atmospheric conditions.

It is, therefore, necessary to consider the changes needed to avoid crashing into these environmental barriers. Ultimately, our economy will have to fit within its natural

limits and be constructed in such a way as to be automatically constrained by those limits. Given that this is a medium to long-term challenge to the world economy, more immediate ways need to be found to "lighten the load" (Postel 1994) on the earth so as to provide some time for this change, at the same time as paving the way for it. Postel refers to World Bank economist Herman Daly's analogy of the Plimsoll line on a ship. As the ship is more and more heavily loaded it will settle lower into the water, which will eventually reach the level of this line. The Plimsoll line indicates the point at which the ship becomes dangerously overloaded. Indications are that the environmental resources of the world may be nearing this critical mark.

The South African playwright and comedian Pieter-Dirk Uys described the desperate manoeuvres of the government in the dying days of apartheid as "rearranging the deck-chairs on the Titanic". The same can be said about Daly's example—moving the items around on the ship will not help either; what needs to be found are strategies to lighten the burden. This "lightening of the load" is the broad immediate challenge to the global economy and is the context for our approach in this book. There are a number of major issues in this regard, including inequitable distribution of income, rapid population growth and resource-consuming economic expansion.

In the South African context, the first of these challenges is a cornerstone of the government's economic and development policy, and the second is also receiving attention. It is the third challenge that is inadequately understood and to which we hope to direct economic and industrial policymakers' attention.

The challenge of resource-consuming economic expansion cannot be met in South Africa by an opposition to economic growth *per se*. Growth is clearly a prerequisite for the reconstruction and development of post-apartheid South Africa. Rather, we need to focus attention on the nature of this economic expansion. We need to build an approach to human and economic development which includes a more deeply considered and appropriate use of technology, and which has environmental and natural resource issues as a cornerstone.

Such an approach must be supported by an improved system of environmental management—integrating company-level management, government regulation and new partnerships with labour and civil society into an effective system. As the chapters of this book show, changing the approach to economic development in South Africa, and the environmental management of it, will be a complex and difficult process. It is possibly a more manageable challenge if one sees it as a process with an end-point of sustainable development rather than an immediate and wholesale about-turn.

The broad medium-term elements of this process will probably include defining methods for internalising the environmental costs of production, building indicators of progress towards sustainable development into both firm-level and national-level accounts and developing new and innovative approaches to industrial production (such as closed-cycle processes). In the long-term, however, changed attitudes to consumption, consumerism and lifestyles must be seen as part of a longer-term reorientation of economic patterns.

## A sustainable development path for South African industry?

The central issue that we confront in this volume is how to shift industry onto a more sustainable path of development. Such a path would take greater account of the use of natural resources which either serve as inputs to industry or receive its waste. The key question is what kinds of public policies would encourage industries to take greater account of their short and long-term effects on the environment and to constantly improve their environmental performance, and how to accomplish this in the context sketched above of relatively weak pressures from the local consumer market and public groups.

The approach we take is one of recognising that there are a number of important factors in industrial environmental management which need to be harmonised. The first set of questions this raises concerns the proper approach to regulation by public authorities. How do public authorities provide the right context for industry? How do they act in a determined yet innovative way? Can they cooperate with industry and take a partnership approach but still, where necessary, wield a big stick?

The second important question is the role of domestic and international markets in providing the incentives for environmental innovation and continuous upgrading. Linked to the market is the role of civil society, environmental groups, trade unions, political parties and consumer movements in shaping what the market demands. The third question concerns the critical role of industrial managers who control the very processes of industrial production. They make the key decisions on environmental investments, on techniques of production and on waste disposal. They know their workplaces better than anyone else and are the most likely source of innovation if they are sufficiently interested in their environmental impact. At stake for industrial managers as a group is the acceptability of their products to the market, their risk of liability, their public image, the long-term sustainability of the resources on which they depend and the quality of their environment. Linked to this is the role of workers and their trade unions. Workers are intimately involved in production, in the disposal of waste and in the transport of hazardous substances. At stake for them is their health, the security of their jobs, the environment in which their communities live and the development of the local economy.

How can these factors be knitted together by public policy? How can the law be laid down effectively to provide a baseline of protection for the environment, the public and the health of workers? How do we move beyond the legal and regulatory approach towards an effective partnership with industry? How do we inspire managers and provide incentives for them to continuously improve the environmental impact of the activities they control? How do we empower workers and their unions to protect their own health effectively and become "champions for the environment"? (Whyte 1995: 27)

## How does this volume begin to answer these questions?

This book is an attempt to begin to answer these questions. It starts out by exploring macro-level issues that affect all industries and then moves on to case study material. The more generic issues covered are environmental legislation, energy supply, the environmental aspects of trade and environmental information systems. We then look at the role of

organised labour in environmental management and at case studies in the chemical industry and the small and medium-sized sector. We conclude with a discussion of the implications of this work for environmental policy in South Africa.

Chapter 1 sets out the current legislative and regulatory framework which governs industry's environmental impact. In this piece Lazarus, Currie and Short argue that there are a number of key problems with environmental legislation. The environmental legislation which governs industry should achieve two key outcomes: it should protect the environment in an ongoing manner and it should facilitate investment where that investment is environmentally appropriate. At present the lack of suitable legislation and regulatory capacity leads to the worst of both worlds—in many cases investment is impeded by uncertainty and conflict over environmental impact and, yet, in many others, the environment is inadequately protected. Legislative change is required, including a proper framework for incorporating environmental impact assessments into the process of industrial planning. Greater regulatory capacity is also needed, and this is addressed here and in a number of other chapters.

Chapter 2 is a condensed version of a longer study written for the ISP. In the study Van Horen argues that while South Africa's extremely low electricity price is a key source of comparative advantage for sections of industry, the price does not accurately reflect the social and environmental costs that are incurred in its production. In the dominant, coal-fired segment of electricity supply, externalities include injuries and mortalities in coalmining, the local health effects of particulate and other emissions and the global effects of carbon and other greenhouse gases. Using an internationally established methodology, Van Horen estimates these costs and calculates their potential impact on the electricity price. In so doing, he argues that it may not be appropriate to try to realise all of these costs in the electricity price itself, but that the hidden costs need to be understood, calculated and, where possible, ameliorated.

Chapters 3 and 4 address aspects of trade and environment. In Chapter 3, Bethlehem argues that international environmental pressures are beginning to be felt by South African exporters. Most of these pressures are market-based and are ultimately driven by consumer concerns and activism in the North. Others arise from environmental regulations and international environmental agreements. So far, most exporters seem able to adapt to the new requirements but there are cases where companies lack the investment capital and/or the information required to respond appropriately to international pressures. In Chapter 4 Gibson and Van Seventer make a case for a locally led programme of environmental reform. Using a dynamic general equilibrium model they calculate the overall costs to the economy that would be incurred if South Africa were forced by outside pressure to suddenly reduce emissions of certain substances. The modelling exercise shows that if, in order to achieve these reductions, the economy would be forced to contract in key industries where such emissions were produced, there would be a strong negative impact on output, employment and exports. Although Bethlehem concludes that current international pressures are not likely to result in strong, sudden target-based pressures being applied to South Africa in the short-term, and although elements of their modelling exercise are hypothetical, the lessons of Gibson and Van Seventer's modelling exercise are never-

theless profound. Variables, which can be adjusted in the model, cannot easily be adjusted in the real world. For example, an absolute reduction in carbon dioxide ( $\text{CO}_2$ ) emissions in the electricity sector would require a shift away from coal, which is unviable in the foreseeable future. Despite the hypothetical nature of the exercise, it is useful because it paints conceptual scenarios and begins to integrate environmental and economic data. In particular, the work underscores the need for locally led, long-term programmes of improvement in industry's environmental performance and for macro-level tracking of the effects of environmental pressures on the economy.

Chapter 5 examines the question of environmental information. Goldblatt shows that a number of countries trace industrial emissions to the environment by establishing pollution registers or similar listings of emissions. Regulations require that companies submit information on their emissions of listed substances and these are recorded in a publicly available inventory. This information makes the management of pollution more manageable and empowers communities by allowing them to trace what substances are being released into their local environments. This allows for better interventions to planning, health care and a number of other public processes. Goldblatt explores the possibilities and implications of establishing such a system in South Africa and argues for its consideration by the environmental authorities.

Chapter 6 looks at the environmental management of small, medium and micro-sized enterprises (SMMEs). Coleman notes that South Africa's new government is strongly encouraging the development of this sector and is providing various forms of support for emerging business. One problem with this is that SMMEs are generally poorly equipped to manage their environmental impact. They often lack the knowledge, skills, equipment and management systems that are required to control their environmental impact in general and their waste in particular. They are also, generally, under far less public pressure than the large companies, and they get less attention from regulatory authorities. Yet, the growth of this sector is critical to the expansion of employment and to considerations of equity and innovation. How, then, can the public authorities assist small businesses to upgrade their environmental capacities and to regulate their impact effectively? In considering these questions Coleman looks at SMMEs in the Western Cape that are involved in automotive servicing. She traces their difficulties with various environmental problems, including the disposal of hazardous waste and the protection of workers' health. She concludes with a number of suggestions which can be taken up by government, including the provision of collective waste management facilities, improvements to regulatory frameworks and environmental capacity support for managers in small firms.

Chapters 7 and 8 deal with the process of environmental management at the workplace and, particularly, with the role of trade unions. Chapter 7 examines the role of trade unions directly. Magane, Miller, Goldblatt and Bethlehem start off by evaluating the role that progressive trade unions have played in influencing health and safety policy and practices and, more recently, environmental concerns. They argue that the unions have had an important influence on the direction of health and safety legislation and policy, but that their capacity to help implement better policies in the factories is uneven. Some unions have played a strong role in health and safety management, and this has been especially

so in the mining and chemical sectors. Many other unions have, however, lacked this capacity and most unions are limited in their ability to make detailed, technical interventions on the factory floor. Where unions enjoy this capacity it is often strongest on the safety side rather than on the longer-term and less obvious health impacts. On the environmental side, unions' involvement has grown in recent years. Various unions have played an important role in local struggles, as well as in the national policy debates. However, environmental issues are less squarely on union agendas than health and safety ones, and the links are not always obvious. While it is not appropriate for South African unions to try to make environmental issues their *raison d'être*, there is important work to be done to strengthen their environmental capacity and, especially, to empower shop stewards to represent members' health, safety and environmental rights.

Chapter 8 traces the history of the environmental conflict at Thor Chemicals, a company based in KwaZulu-Natal. This case study was chosen because of the high profile it has acquired in environmental debates and because of the lessons it can teach us about environmental regulation. Butler sets out to ask why such a dramatic violation of environmental and health and safety protection was able to occur. What is it about South Africa's environmental regulatory system that allowed a situation to develop which ultimately resulted in workers losing their lives, and in severe damage to the water and soil resources in the area? And what about South Africa's legislation resulted in such small fines being paid by the company once the case had been tried? The study also raises important questions about the place of trade unions in the management of health, safety and environment, and their role in environmental alliances. The lessons that Butler draws include the need to improve the role of regulatory officers in the civil service and to re-examine the judicial capacity to enforce environmental legislation.

In the Conclusion we focus on the policy changes that are suggested in this volume. We argue that there are indications that important aspects of South Africa's industrial path are unsustainable and that our development imperatives call for a shift in the environmental management of industry. The important question is: what are the levers that can be used to shift industry and improve its performance? Here we focus on the question of appropriate forms of regulation as well as active environmental partnerships between business, government and trade unions. We look at various mechanisms including legislative change, sectoral target-setting, more integrated forms of environmental inspection, more proactive reporting requirements and ways of supporting environmental innovation. We conclude with some specific recommendations.

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## chapter 1

# THE LEGISLATIVE FRAMEWORK

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## Environmental law, investment and industrial practice

Peter Lazarus, Iain Currie and Rob Short

### Introduction

Notwithstanding the efforts of environmental lawyers and legislators, current South African environmental law has little influence over long-term strategic industrial decision-making. The response of many South African industries to environmental law is reactive rather than proactive. South African environmental law is not designed to encourage long-term environmental planning by industry. This is largely due to problems of fragmentation and poor enforcement.

At the same time confusion over industry's environmental responsibilities creates a difficult context for new industrial developments. The absence of clear legal guidelines for environmental impact assessments and other means of managing the environmental impacts of new investments, leads to conflict between communities and developers. The law is not helpful in resolving these conflicts. As a result, investments are sometimes unnecessarily delayed.

In South Africa today we have, in some sense, the worst of both worlds. Environmental laws fail to regulate industrial activities in a way that adequately protects the environment in the long-term. Yet, at the same time, in the short-term, environmental law fails to provide guidelines which would allow new investment decisions to be made in a rapid and environmentally responsible manner.

While South Africa is not short of environmental law, it is short of effective environmental law. In addition to certain gaps in the law itself, this ineffectiveness has two fundamental causes: the first is inadequate enforcement of environmental law and the second a lack of effective administration and management of environmental quality. With regards to enforcement, environmental law is ineffective, not only because the penalties for environmental damage are seldom severe enough to deter polluters but also because the existing body of environmental legislation is weakly wielded. Whatever deterrents or incentives there may be on the books, these all too often remain unregulated in practice. Effective administration, including development of the law and improvement in the quality

of its enforcement, is hampered by a lack of clear policy direction by government.

The constitutional devolution of governmental power over the environment to the nine provinces has further complicated the administration of environmental quality control, exacerbating the problems created by the absence of a coordinated approach to environmental management. No matter how far-reaching and well-intentioned, environmental law cannot be effective without adequate enforcement, penalties for contravention and administration.

Recently, however, there have been some promising signs of change. The development of the consultative national environmental policy process and the integrated pollution control process, discussed in this chapter, herald a new era for environmental management in South Africa. As these processes take root, and especially if they impose stringent environmental management and pollution control requirements, industry will be forced to reconsider production processes. It is then that environmental law will begin to assume a significant role in influencing industrial strategy.

This chapter is an overview of the changing constitutional and institutional context of environmental law in South Africa. It provides a brief description of current environmental legislation and details recent developments and trends in environmental law and policy. Throughout the chapter, the often considerable gap between environmental law and the practices of enforcement agencies and of industry are noted. The chapter concludes with several suggestions for narrowing that gap, seeking a way to ensure that environmental considerations are incorporated into industrial planning decisions.

## **The impact of the Constitution on environmental law**

The effect of the Constitution<sup>1</sup> on environmental law and its administration can be divided into two categories:

- the Constitution contains a number of federal elements, dividing governmental powers between the national and provincial levels of government. The power to make and administer law in respect of the environment is placed in the hands of provincial governments. At the same time, national government retains the power to make and administer environmental law in certain circumstances; and
- the Constitution requires current and future legislation and the conduct of the government to conform to the provisions of the Bill of Rights. The Bill of Rights contains a specific right to a healthy environment as well as a number of rights pertaining to the conduct of the administrative powers of government that will affect the administration and enforcement of environmental law.

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<sup>1</sup> References in this chapter to the Constitution are to the Constitution of the Republic of South Africa, 1996, adopted by the Constitutional Assembly on 8 May 1996. References to the interim Constitution are to the Constitution of the Republic of South Africa, Act 200 of 1993. At the time of writing, the Constitution was not yet in operation, having been referred to the Constitutional Court for certification in terms of Chapter 5 of the interim Constitution. Once certified, the Constitution will come into operation on a date established by the President by proclamation, but no later than 1 January 1997 (section 244).

## The constitutional distribution of powers over the environment

Under the pre-1994 constitutional dispensation, legislative authority over the environment was centralised, while responsibility for the administration of environmental law was fragmented (Loots 1996). While Parliament had the power to legislate over all aspects of environmental protection, the administration of parliamentary legislation was divided between a number of national government departments and provincial and local authorities. Under the 1996 Constitution, both legislative and administrative control over the environment is fragmented.

The Constitution accords legislative powers to provincial legislatures and governments, concurrent with those of Parliament and the national government, over a list of functional areas. The list includes the areas of agriculture, administration of indigenous forests, nature and soil conservation, planning, pollution control, tourism and recreation, as well as the functional area of "environment" itself. Provincial legislation prevails over parliamentary legislation in the listed functional areas except in certain circumstances. According to section 146 of the Constitution, national legislation will prevail over provincial legislation if it deals with a matter that cannot be regulated effectively by legislation enacted by individual provinces; if it provides for national uniformity of norms, standards, frameworks or policies; if it is necessary for the maintenance of national security, economic unity, the protection and promotion of economic activity across provincial boundaries, the promotion of equal opportunity or equal access to government services or the protection of the environment; and if it is aimed at preventing unreasonable action by a province that is prejudicial to the economic, health or security interest of another province or the country as a whole or impedes the implementation of national economic policy.

Thus, for example, an Act of Parliament seeking to implement Republic-wide environmental standards in accordance with international legal obligations would prevail over a provincial law that failed to measure up to such norms and standards since it provides for national norms and standards and is aimed at the protection of the environment. In effect, then, responsibility for legislation and administration of environmental law is in the hands of the provinces, subject to the power of the national government to lay down national policy and to override provincial legislation in a number of circumstances.

Most environmental legislation endows government officials and bodies with the power to enforce and administer its provisions (Loots 1994: 17-22). Administrative officials may, for example, be authorised by legislation to issue regulations or other forms of delegated legislation that supply the practical and technical detail of environmental management. Activities that may threaten the environment are usually controlled by issuing permits and licences and by monitoring or inspection by government officials. The constitutional division of administrative power, therefore, has crucial significance for environmental law.

In terms of the Constitution, the executive authority of the Republic vests in the President and Cabinet. Provincial executive authority vests in the premiers and executive councils of the provinces. Provinces have executive authority to administer provincial legislation, to administer national legislation falling within the functional areas listed in schedules 4 and 5 of the Constitution unless that national legislation provides otherwise, and to administer functions specifically delegated to the provinces by national legislation.

Currently, the Department of Environmental Affairs and Tourism plays the major role in the administration of environmental affairs at a national level in South Africa. The department is principally responsible for formulating general environmental policy and coordinating and monitoring the administration and application of this policy by the different national executive institutions. Several other central government departments are also involved in environmental management. The land-use planning function is the responsibility of the departments of Land and Agriculture Affairs. The conservation of soil and control of agricultural resources fall under the jurisdiction of the directorate of resource conservation of the Department of Agriculture.

The management of water resources falls under the Department of Water Affairs and Forestry. Certain health aspects of water quality, radiation and air pollution fall under the jurisdiction of the Department of Health. The responsibility for controlling oil pollution at sea is shared by the departments of Transport and of Environmental Affairs and Tourism. The Department of Education and the National Monuments Council are responsible for the preservation of certain cultural and historical assets. The Department of Mineral and Energy Affairs exercises control, through its mineral laws administration branch and the government mining engineer, over energy matters and the exploitation of minerals.

It is clear that a number of the powers currently administered by central government fall within the areas of executive competence of the provinces. This means that competence to administer existing powers delegated by parliamentary legislation and currently administered by central government will fall to the executive authorities of the provinces once powers of administration under that legislation are assigned by the President.<sup>2</sup> In terms of the constitutional division of power, central government will retain administrative competence in respect of the formulation of general policy; the implementation of minimum, Republic-wide norms and standards; and executive functions in respect of environmental matters which have implications across both provincial and national boundaries (such as, for example, air pollution controls). Further, as outlined above, central government will retain responsibility for the implementation of policy, norms and standards that derive from South Africa's international law obligations. Remaining delegated legislative powers and functions should then be assigned to the relevant provincial authority once the province has the administrative capacity to exercise and perform those powers and functions. This process commenced in 1995, under the interim Constitution, with the assignment to provinces of powers and functions contained in the Environment Conservation Act 73 of 1989, the Mountain Catchment Areas Act 63 of 1970, the Transvaal Nature Conservation Ordinance of 1983 and the Sea Shore Act 21 of 1935 (Loots 1996: 3).

The devolution of environmental management powers and functions to the provinces in terms of the interim and final constitutions runs counter to the idea that centralisation is essential for the formulation and implementation of an efficient and integrated environmental management policy. Instead, environmental management is placed in the hands of the executive authorities of nine provinces, with widely differing administrative capacities, resources and priorities. Provincial boundaries cut across

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<sup>2</sup> In terms of Schedule 6 of the Constitution.

environmental boundaries, the effect of which is that bioregions such as catchments may become the administrative responsibility of a number of provinces. It is suggested that a single, strong government department or agency would be far more effective in forcing compliance with environmental legislation.<sup>3</sup>

Despite the devolution of environmental law powers to the provinces, the Constitution permits a measure of central control in the form of national powers of standard-setting and policy formulation. Proper use of these powers would allow some of the benefits of centralised administration of environmental law to be achieved within the limits imposed by the federal elements of the Constitution. A strong national department of the environment with responsibility for all aspects of environmental protection would be able to control and guide provincial law-making and administration of environmental matters by prescribing policy and national minimum standards (Loots 1996: 6).

### Fundamental rights

Chapter 2 of the Constitution sets out a number of fundamental rights. A law or administrative action which violates any of these rights will be unlawful, unless the limitation of the right in question can be justified by the government.<sup>4</sup>

The inclusion of an environmental right in the Constitution is likely to influence judicial decision-making by requiring that due weight be given to environmental considerations, traditionally undervalued by the courts.<sup>5</sup> For example, the Indian Supreme Court has used the environmental right provided for in the Indian Constitution to order the temporary closure of a limestone mine, the operation of which adversely affected life in a nearby

<sup>3</sup> International experience suggests that the enforcement of environmental law is improved by the establishment of a central government organ to administer and enforce legislative requirements. In 1982 the United States Environmental Protection Agency established a federal programme to investigate and prosecute environmental crimes in conjunction with the land and natural resources division of the United States Department of Justice. The Environmental Protection Agency hired a group of special investigators, and the Department of Justice organised a special environmental crimes unit to prosecute the cases identified by Environmental Protection Agency investigators. Between 1983 and 1990 the environmental crimes unit indicted 761 individuals and corporations. In 1990 its rate of successful prosecution was as high as 85%. Similarly, the British Environment Protection Act 1990 establishes a single agency—Her Majesty's Inspectorate of Pollution—to control industrial pollution.

<sup>4</sup> Section 36 of the Constitution provides that fundamental rights may be limited only in terms of law of general application and only to the extent that the limitation is reasonable and justifiable in an open and democratic society based on human dignity, equality and freedom, having regard to all relevant factors, including:

- (a) the nature of the right;
- (b) the importance of the purpose of the limitation;
- (c) the nature and extent of the limitation;
- (d) the relation between the limitation and its purpose; and
- (e) less restrictive means to achieve the purpose.

<sup>5</sup> Section 24 of the Constitution provides that everyone has the right:

- (a) to an environment that is not harmful to their health or well-being; and
- (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:
- (i) prevent pollution and ecological degradation;
- (ii) promote conservation; and
- (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

village. The mine was required to show how it could mitigate the harmful effects of its activities.<sup>6</sup> Without the constitutional recognition of an environmental right, a South African court faced with the same case would in all likelihood consider the private law rights of the mine-owners to exploit their property to outweigh the public interest in a healthy environment.

The environmental right requires the government to take legislative steps to protect the environment and justifies such steps if they clash with other rights (such as, for example, the right to property). A significant implication of the environmental right is the result of the fact that it not only binds the state in its relations with individuals, but that individuals may assert their rights against the state and against other individuals.<sup>7</sup> This means that where a person's right to a healthy environment is violated by the actions of a private individual or company, that person may invoke the right and may seek the relief provided for in the Bill of Rights.

The availability of a constitutional right and a remedy for the breach of that right is of particular importance for the enforcement of environmental law. There are a number of non-governmental environmental and human rights organisations in South Africa which would be willing to initiate litigation on environmental issues against industries which cause environmental degradation and government agencies which fail to comply with their legal obligations. Without a constitutional right, two major obstacles stood in the way of such litigation: lack of *locus standi* and lack of funding. While the Constitution does not address the funding obstacle, the common law rule of standing that a plaintiff must be personally adversely affected by the wrong which gives rise to the action is considerably relaxed. Where a violation of fundamental rights is concerned, relief may be claimed by any person, including an organisation, acting in the interests of any other person or class of persons adversely affected by the infringement. As a result, an organisation may litigate in the public interest or claim relief in a representative capacity on behalf of persons adversely affected by illegal conduct.

Administrative law principles have made a significant contribution towards ensuring that environmental factors are taken into account in the exercise of administrative discretion. The administrative justice section of the Constitution guarantees lawful, reasonable and procedurally fair administrative action. The section grants a right to everyone adversely affected by administrative action to be given written reasons for that action.<sup>8</sup>

<sup>6</sup> *Kinkri Devi v. State of Himachal Pradesh* 1988 AIR 4.

<sup>7</sup> Section 8(1) of the final Constitution provides that the Bill of Rights applies to all law and binds the legislature, the executive, the judiciary and all other organs of state. Section 8(2) provides that a right in the Bill of Rights binds all natural and juristic persons if, and to the extent that, it is applicable, taking into account the nature of the right and of any duty imposed by the right. Activities that impact on the environment and which may affect environmental rights cannot conceivably be said to be restricted to public, state or government activities. The activities of private natural and juristic persons impact on the environment at least as much as those of the government. It follows that the environmental right in section 24(a) binds individuals as well as the state. The right in section 24(b), because of its reference to "legislative and other measures", imposes duties solely on the state and, therefore, is binding only on the state.

<sup>8</sup> Section 33 of the Constitution provides:

(1) Everyone has the right to administrative action that is lawful, reasonable and procedurally fair.  
 (2) Everyone whose rights have been adversely affected by administrative action has the right to be given written reasons.

A right closely related to the right to reasons for administrative decisions is the right of public access to information held by the state. The right granted in the Constitution is a blanket right of access to all state information.<sup>9</sup> Taken together, these rights will alleviate the absence of information relating to state actions that has hitherto frustrated the conduct of environmentally based litigation.

Administrative justice rights will further affect current and future environmental legislation by prohibiting the granting of wide or unbounded discretionary powers to officials. The exercise of discretionary powers granted without an adequate legislative framework of standards constraining those powers may violate the right to lawful administrative action. The clauses may require that reasonable standards be set out in legislation against which the exercise of discretion may be measured. This may require considerable redrafting of environmental legislation.<sup>10</sup>

A constitutional right to property may place considerable limits on environmental law. Environmental laws and regulations will have to fall within the constitutionally permissible limits of state interference with property rights. The Constitution prohibits the expropriation by the state of "rights in property" without payment of just and equitable compensation. Since many environmental statutes may entail restrictions on the use of private property, the property clause may require payment of compensation if such restrictions are interpreted as expropriations of rights to property.

### **Strict liability**

Strict liability clauses are a feature of environmental law in many countries. A strict liability clause in an environmental statute provides that fault in the sense of careless or intentional wrongdoing need not be established by the state (in the case of a criminal prosecution) or by a plaintiff (in the case of a civil action) in order to impose criminal or civil liability on the polluter. Ownership or control over the operations of a polluting facility would result in liability if it were established that pollution emanated from that facility. Strict liability provisions may impose liability to compensate authorities or individuals who have incurred clean-up costs, or may facilitate individual claims for damages brought by individuals injured by the pollution.

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<sup>9</sup> Section 32 of the Constitution provides that:

(1) Everyone has the right of access to:  
 (a) any information held by the state; and  
 (b) any information that is held by another person and that is required for the exercise or protection of any rights.  
 (2) National legislation must be enacted to give effect to this right, and may provide for reasonable measures to alleviate the administrative and financial burden on the state.

<sup>10</sup> For example, the powers such as those granted to the Minister of Water Affairs by section 9A of the Water Act 54 of 1956 to "control, limit or prohibit" the use of public water "whenever in his opinion a shortage exists or is likely to arise" to the extent that "he in the public interest may deem expedient and in the manner and subject to such conditions as he may think fit" may be unconstitutional. In the absence of any statutory definition of the public interest, the minister's powers amount to an unbounded or subjective discretion. Such a discretion may fail to meet the requirement of section 24(d) that administrative action is "justifiable in relation to the reasons given for it". See Derek Spitz, "Water law and the Constitution" in "Submission to the Department of Water Affairs and Forestry by the L&PC water law legal grouping" (Land & Agriculture Policy Centre, August 1995: 91-95).

In South Africa a number of strict liability measures have been enacted.<sup>11</sup> It is unclear, however, whether such measures are constitutional. Where a strict liability clause assists the imposition of criminal liability it will violate the right to be presumed innocent in terms of the Constitution. In the criminal field, at least, it is unlikely that strict liability clauses will survive constitutional challenge unless the state is able to satisfy the test for the limitation of fundamental rights. This will, at the minimum, require such provisions to be narrowly tailored to ensure that the risk of conviction of innocent people is minimised.

As for the imposition of civil liability, it is arguable that a strict liability measure may violate the right to non-discrimination, in so far as certain classes of persons (plaintiffs in environmental litigation) are unfairly favoured at the expense of another class of persons (defendants in environmental litigation). To withstand constitutional scrutiny, strict liability measures would have to be justified as a reasonable limitation of the right, rationally related to the goal of securing the protection of the environment.

### **Environmental legislation regulating industrial projects**

Apart from controls exercised by land-use planning legislation, the most important body of environmental law affecting industry is pollution control legislation. Pollution control in South Africa is characterised by a number of problems. The principal obstacle to an effective pollution control regime is an uncoordinated approach by the various regulatory authorities recognised by the legislation. Moreover, the environmental objectives of much pollution legislation is not made clear and, in some cases, individual pieces of legislation conflict with others.

Enforcement of the pollution laws has clearly been inadequate, particularly when it has been delegated to local administrative structures. This is the result of a lack of clear direction and training from the central structures, which have not seen the development of capacity at the different levels of government as a strategic imperative that ensures the successful implementation of legislation. A prevailing perception of the system is that there is too cosy a relationship between industry and the regulatory authorities, as is evidenced by low prosecution levels. Certainly, the authorities are constrained by a lack of resources, a lack of qualified personnel and by the legislation itself.

Pollution control is administered by a number of national, provincial and local government departments. Responsibility for air quality was previously administered by the Department of Health but is now administered by the Department of Environmental Affairs and Tourism. Hazardous substances are regulated by the departments of Health and Labour. Freshwater pollution is controlled by the Department of Water Affairs and Forestry, sea-water pollution by the departments of Environmental Affairs and Tourism, Water Affairs and Forestry and Transport. The use of pesticides and fertilisers is controlled by the Department of Agriculture. The control of solid waste is particularly unsatisfactory, some aspects falling

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<sup>11</sup> Sections 22A and 22B of the Water Act 54 of 1956; section 31A of the Environment Conservation Act 73 of 1989; section 9 of the Combating of Pollution of the Sea by Oil Act 6 of 1981 and section 61 of the Nuclear Energy Act 131 of 1993.

under the Department of Environmental Affairs and Tourism, others under the Department of Water Affairs and Forestry and most aspects being taken care of by local authorities with little or no guidance from central government (Loots, unpublished note). As has been noted above, provincial legislatures now have the power to make law regarding pollution control and the provinces will either administer those laws themselves or delegate power to local authorities.

The integrated pollution control process aims to address the currently fragmented administration of pollution management. At present, however, a cross-media approach to pollution control is entirely absent in legislation.

### Air pollution control

The control of air pollution in South Africa is effected by means of one comprehensive statute: the Atmospheric Pollution Prevention Act 45 of 1965. The only other legislation which deals with limited aspects of air pollution control are the Health Act 63 of 1977, regulations in terms of the Mines and Works Act 27 of 1956 (still applicable in terms of the Minerals Act 50 of 1991) and the Road Traffic Act 29 of 1989. The Atmospheric Pollution Prevention Act is administered by the Department of Environmental Affairs and Tourism.

The Atmospheric Pollution Prevention Act controls four types of atmospheric pollution: noxious and offensive gases, smoke, dust and vehicular emissions. Noxious and offensive gases, which are defined in the Act to include a large number of compounds caused by industrial pollution, are controlled by requiring operators of certain scheduled processes,<sup>12</sup> within controlled areas, to obtain from the chief air pollution control officer a registration certificate authorising the continuation of that process. Since 1968 the whole of South Africa has been declared a controlled area.<sup>13</sup>

The chief air pollution control officer is authorised to grant such a certificate if satisfied that "the best practicable means" are being adopted for preventing or reducing to a minimum the escape into the atmosphere of noxious or offensive gases. "Best practicable means" is defined in the Act to include the provision and maintenance of the necessary appliances to prevent air pollution, the effective care and operation of such appliances and the adoption of any other methods which are practicable and cost-effective within the prevailing technical context. The chief air pollution control officer has interpreted this definition as the assessment of the problems of air cleaning associated with each type of process, of which there may be many examples in the country, and to decide what degree of air cleaning can be achieved, bearing in mind the different techniques available, the costs associated with their installation and operation and the effects which these costs will have on the ability of the firms concerned to operate without financial loss.

Application of "best practicable means" clearly involves a subjective evaluation on the part of the chief air pollution control officer and, in practice, is generally interpreted in collaboration with the industries concerned. As such, no national, or even regional, stan-

<sup>12</sup> At present the second schedule to the Act has 69 scheduled processes listed which are generally considered to be the major causes of industrial air pollution in South Africa.

<sup>13</sup> Government Notice R1776 of 4 October 1968.

dards for air cleanliness have been established, as the degree of industrial air pollution tolerated is largely at the discretion of the chief air pollution control officer. Guidelines for each process, based on concentrations of pollutants emitted, have, however, been laid down by the department and are generally incorporated into specific registration certificates. Once the guidelines form part of a certificate, they become legally binding on the industry concerned. Registration certificates operate as permits which allow the scheduled process to be carried on subject to certain conditions. At present there are approximately 2 000 certificates in operation for approximately 1 200 industrial plans in South Africa.

Both smoke and dust pollution are controlled generally by the declaration of control areas in which certain prescribed steps are required to be taken by persons in control of such pollution-causing activities. Pollution by smoke is controlled by local authorities, whereas dust pollution is controlled at national level. Vehicular emissions, which are in practice inadequately enforced, are nonetheless provided for in the Act by allowing local authorities to conduct inspections of vehicles on public roads.

As is the case with much environmental legislation in South Africa, control over air pollution is highly fragmented, with overburdened air pollution officers appointed by local authorities being responsible to central government and monitoring air quality within their own municipal areas, despite the fact that air pollution does not confine itself to municipal boundaries.

Approximately 200 stations throughout the country monitor the levels of SO<sub>2</sub> and particulate matter in the air, and 150 monitor smoke. About 41 local authorities are involved in this process. In addition, large companies such as Sasol and AECI have their own monitoring stations. A central database of information compiled over the last few years is now available. Monthly reports detailing emission levels are submitted to the department, which requires 90% compliance with the prescribed standard for the industry concerned. Written notice is given to the industry in the event of the acceptable level being exceeded, and non-compliance results in the threat of cancellation of the certificate. It is significant to note, however, that to date only 20 certificates have been cancelled (Petrie 1992).

It has been suggested that the legislative framework created by the Atmospheric Pollution Prevention Act has fragmented rather than consolidated administrative control over air quality. This fragmentation has prevented the existing pollution inspectorate, already inadequately staffed and insufficiently supported with scientific services, from monitoring air quality and compliance with guidelines set out in certificates. The scope of the administrative discretion given to the chief air pollution control officer and the local authorities must also be reviewed if South African air quality control is to match standards in Europe and the USA.

Clearly undermining the efficacy of current air quality control is the very low sanction attached to air pollution offences. In some states in the USA, for example, penalties for air pollution may be as high as \$25 000 per day of the offence, compared to R500 in South Africa. Also of concern is the fact that emissions in South Africa are controlled by guidelines, which only become legally binding once incorporated into a certificate, as opposed to a system of uniformly applicable emission standards.

It is widely accepted that current air pollution legislation has done little to improve

air quality in South Africa. Since the promulgation of the Atmospheric Pollution Prevention Act in 1965, air quality in South Africa has steadily declined. Although most industries that generate significant quantities of aerial emissions are scheduled processes in terms of the Act, the standards required by the Act are fairly open-ended and are dependent on the subjective judgement of the chief air pollution control officer. Air pollution control tends to be focused on the reduction of visible particles in aerial waste streams or waste streams that give rise to visible pollution, for example, NO<sub>x</sub> and its formation of photochemical smog.

Despite the absence of meaningful incentives and sanctions, a number of South African industries have installed air pollution control technology. However, this technology has often been in the form of electrostatic precipitation to remove particulate matter from aerial waste streams so that emissions from stacks become less visible. Furthermore, many industries have introduced air pollution reduction targets as part of their internal, self-regulatory process of environmental management. In the face of weak and poorly enforced air pollution legislation it is safe to conclude that industry will not develop air pollution reduction programmes in response to a fear of increased liability from air pollution prevention legislation. In the absence of legislative change, reductions in industrial air emissions would have to be fuelled by international pressures, demands from non-governmental organisations and the public or profit incentives.

### **Water pollution control**

South African water law is currently in transition. A process aimed at redrafting the Water Act 54 of 1956 was initiated by the Department of Water Affairs and Forestry in March 1995. After extensive public consultation and the appointment of two panels consisting of experts from within and outside the department, a discussion document was released by the minister in April 1996, containing a set of principles on which the final legal structure of South African water law is to be based (Department of Water Affairs and Forestry 1996). After further public consultation relating to the principles, the final phase of the process will involve the drafting of new legislation in accordance with the principles under the supervision of a team of legal experts.

Many of the principles that have been developed are aimed at redressing historical inequalities in the allocation and distribution of water rights. Most fundamentally, the principles propose a uniform allocation system in terms of which all water has a similar legal status and over which the state has control. At this stage the details of the new allocation mechanism have not been finalised, but it is unlikely that it will significantly undermine the security of industry's right to use water.

One of the principles regarding water resource management approaches, however, is of specific interest. The principle states that "water quality management options should include the use of economic incentives and penalties to reduce pollution; and the possibility of irretrievable environmental degradation as a result of pollution should be prevented" (Department of Water Affairs and Forestry 1996: Principle D5). The explanatory text accompanying this principle makes specific reference to a commitment to the "polluter pays" principle in the case of waste disposal and, furthermore, provides the way for a marketable system of water rights and, possibly, the trading of a form of pollution credits.

Unlike environment, water is an area of national competence in terms of the Constitution. The national Department of Water Affairs and Forestry is thus responsible for all water affairs in South Africa but is assisted by numerous regional offices throughout the country. Apart from the Water Act, there is a wide variety of legislation dealing with water pollution and a number of government departments are involved in its administration. This, together with the control exercised by individuals in terms of private rights to water, has fragmented the administrative control of water. It is the stated policy of the Department of Water Affairs and Forestry, reflected in the principles on water law reform, to manage the water resources of the country on a catchment basis. Catchment boundaries do not, however, generally coincide with political or provincial boundaries. The effect of this is that in one catchment more than one administrative body may have authority to manage the water resources in their respective areas of jurisdiction.

The Department of Water Affairs and Forestry accepts that the concept of zero pollution is not its goal. Water is a scarce resource in South Africa and reused effluents are considered vital supplements to fresh-water resources. Rather, the Department of Water Affairs and Forestry's policy is embodied in the concept of "fitness for use", which aims to ensure that water of acceptable quality continues to be available for recognised uses, such as urban, industrial, agricultural, recreation and conservation. The "fitness for use" concept is thus relative, recognising that different users require different qualities of water. A major problem with the application of the concept, however, is that users who fall outside the definition of "recognised users", such as informal settlements or many rural communities, have no assurance that water which satisfies their needs will continue to be available.

From a pollution control perspective, in order to achieve "fitness for use", the sources of the pollution need to be monitored. Thus far the pollution control strategies of the Department of Water Affairs and Forestry have focused on the control of point sources of pollution and have largely ignored the impact of diffuse pollution sources. Since 1991 the Department of Water Affairs and Forestry has begun shifting its control strategy from the uniform effluent standards approach to the receiving water quality objectives approach. The implementation of this approach is, however, proving more difficult than was originally anticipated. In practice, therefore, the uniform effluent standards approach remains the basis of the department's practice and remains the approach provided for in legislation.

The uniform effluent standards approach aims to control the quality of effluents that enter the water environment by requiring that effluents conform with certain prescribed standards set at technologically and economically attainable levels. The relaxation of these standards is usually negotiated in individual cases on the basis of technological or economic considerations. The standards were initially aimed at limiting the rate of deterioration in water quality by focusing on pollution and promoting waste water treatment technology.

The receiving water quality objectives approach was adopted in view of the fact that, notwithstanding the uniform effluent standards approach, the quality of South African water resources was continuing to deteriorate. Part of the reason for this was that standards were frequently set and exemptions granted without knowledge of the impact that these may have had on the receiving waters. The receiving water quality objectives approach provides that in certain catchments, effluents should be discharged to the sur-

face drainage system without the quality specifications of the receiving water (based on the needs of downstream users) being exceeded.

While the receiving water quality objectives approach is a major policy advance, it is proving to be difficult and time-consuming to implement. The primary reason for this is that it requires the determination of the water quality needs for each downstream user to calculate the quality and volume of the effluent that can be discharged upstream. As the long-term low-level impacts of marginally unsuitable water quality are largely unknown for many uses, it is difficult to calculate such values. This problem is compounded by the fact that there is no incentive for downstream water users to be more precise about their water quality requirements.

At present, however, the Water Act exercises control over the use of water by industry by regulating industrial water consumption and by regulating the discharge of effluents. To control consumption, section 11 of the Act requires anyone using public water for industrial purposes to obtain the permission of a water court, and in certain circumstances a permit from the minister. These permits essentially provide for a system of reporting back to the department on matters such as the water-saving technologies that industries are using and where and how effluent is being discharged.

To regulate the discharging of effluents, the Act places the onus on industrial water users to purify their effluent to certain standards and, once purified, to return purified or treated water to its origin. At present, uniform effluent standards are prescribed by the minister in consultation with the South African Bureau of Standards. The standards comprise a general standard applied to all catchments, a special standard for specific streams and a special phosphate standard for certain sensitive catchments. These effluent standards as well as the methods of testing waste water or effluents were last updated in 1984 and specify maximum permissible concentrations for a variety of compounds.

A problem with concentration-based standards is that with the increase in the use of water for industrial purposes, an increase in the total load of pollutants that enter the water environment will still result. The fact that single effluent standards do not take into account the total load per volume of the receiving water, means that the standards do not bear any real relation to the overall pollutant load of a river. A further negative side-effect of concentration-based standards is their tendency to encourage an increase in the use of water, since such standards can be complied with if pollutants are sufficiently diluted. Another problem with uniform effluent standards is that by requiring across-the-board compliance, they do not provide any incentive for industry to reduce pollution or to discharge it into the most environmentally advantageous place.

Of all legislation controlling environmental pollution in South Africa, water pollution legislation is arguably the most developed. Provided that the lack of a definition of pollution, the problems with the definition of effluent and the many problems stemming from the inappropriate distinction between public and private water are addressed, a legislative structure for adequate control of pollution is already in place. The solution to South African water pollution problems is, therefore, not principally to be found in legislative changes, but rather in administrative changes aimed at alleviating the fragmented control over water resources and ensuring compliance with legislation.

### Land-based pollution control

Although more than 90% of the 330 million tonnes of waste produced annually in South Africa is disposed of on land, nowhere is the fragmented nature of environmental law more evident than in the area of solid waste management. Control is currently exercised through at least 37 Acts of Parliament, 16 provincial ordinances and numerous local authority by-laws. This body of legislation, administered by numerous government departments, encompasses a diversity of activities which generate waste as well as many different types of waste that are produced.

In the absence of a national waste management policy or a coherent and consolidated Act, solid waste is currently controlled in a haphazard and uncoordinated manner. Legislation concerning waste historically pertained mainly to the prohibition of littering and to refuse removal, and has been administered mostly at local authority level. Apart from the Environment Conservation Act 73 of 1989, the focus of most by-laws dealing with solid waste is on the protection of public health and the prevention of nuisances related to waste. Furthermore, although many of the acts empower administrative officials to make regulations concerning waste management, in practice very few regulations have been made.

It is widely recognised that most legislation dealing with waste management is ineffective because the departments responsible for enforcing the provisions have insufficient personnel to carry out these duties. Most of the departments, therefore, rely on cooperation and/or persuasion of waste generators or disposers, supported by the threat of cancellation or withdrawal of a permit. Prosecution is a far lesser threat, especially in view of the often minor penalties which may be incurred on conviction. To date no convictions have been obtained in terms of the Environment Conservation Act, which is the Act most capable of regulating land pollution. Furthermore, much current legislation exempts government departments from complying with legislative provisions. The potential exists, therefore, for some of the worst polluters to escape regulation entirely.

Although there is no general policy on waste management, certain initiatives and policies emanating from the Department of Environmental Affairs and Tourism, including the integrated pollution control process mentioned above, indicate that there may be a national policy in the near future.

Some progress has, however, been made regarding the development of a hazardous waste management policy. In April 1994, South Africa became a signatory to the Basel Convention on the Transboundary Movement of Hazardous Waste, and in September 1994, the Department of Environmental Affairs and Tourism published a policy on hazardous waste management in the *Government Gazette* for comment.

The policy was widely criticised by various sectors of society, primarily for the lack of adequate consultation with affected parties in the drafting of the policy. It was further criticised for making provision for the importation, in certain circumstances, of toxic waste and for specifically excluding workers from the ambit of the policy. In March 1996 the department convened a workshop of "stakeholders" with a view to developing a way forward for the process. The workshop suggested the formation of a sectorally representative forum which will be charged with the management of the process towards the formulation of a policy on hazardous waste management. A proposal in this regard has been for-

warded to the committee for environmental coordination for approval.

In the interim, the department intends producing regulations which will set out substances which may be imported or exported subject to controls and those substances in respect of which there will be a total import/export ban.

It seems evident from the above that South Africa will in all probability have a national policy on waste management in the near future. However, the danger exists that the problem of fragmented legislation may be overshadowed by vague and overly flexible policies.

The Environment Conservation Act governs the establishment and operation of waste disposal sites. Although the whole Act falls under the auspices of the Minister of Environmental Affairs and Tourism, section 20, which deals with waste disposal sites, is administered by the Minister of Water Affairs and Forestry. To establish, provide or operate a waste disposal site, one is required to obtain a permit from the Minister of Water Affairs.

Although the Act authorises the Minister of Environmental Affairs and Tourism to make extensive regulations with regard to waste management, no such regulations have yet been promulgated. Two sets of draft regulations dealing with waste disposal were, however, issued in terms of the 1982 Environment Conservation Act, but were never promulgated. Similarly, in June 1991, another set of draft regulations, dealing specifically with waste disposal site permits, was issued. These too, however, have not yet become law. In July 1994, the minister published regulations which contain the application form which must be completed by any person who wishes to apply for a permit. This form requires a substantial degree of detail pertaining to the position of the site, water levels, weather conditions, use of adjacent land and substances to be handled.

During the latter part of 1994, the Department of Water Affairs and Forestry produced a series of three documents dealing with the minimum requirements for the handling and disposal of hazardous waste, waste disposal by landfill and monitoring of hazardous waste which are intended to provide a framework within which to enforce the permits and the conditions attached to them. The document adopts the best practicable environmental option policy by means of a threefold process: waste avoidance, correct classification of waste and requirements for the safe handling and disposal of waste.

The document states that the department also envisages the future registration of waste generators and transporters in order to implement a comprehensive waste management system. Should the department formulate legislation in this regard, responsibility and accountability will inevitably be placed on waste generators in addition to waste disposers, which, in turn, will lead to safer environmental practices and, thus, a safer working environment.

In terms of the Environment Conservation Act, the Minister of Environmental Affairs and Tourism is empowered to declare certain activities, such as waste disposal, to be "identified activities", which would necessitate that an impact assessment be completed before permits are issued. Although the minister submitted a list of proposed identified activities for comment in March 1994, at the time of writing the list had not yet been finalised.

In spite of the procedures laid down in the Environment Conservation Act, of the estimated 900 disposal sites that exist in the country, fewer than half have been issued permits from the Department of Water Affairs. In a study conducted for the President's

Council report in 1991 on a national environmental management system, it was found that the majority of local authorities had existing pollution problems and of the sites surveyed, 62% posed a water pollution problem, 65% contributed to air pollution and 71% caused a nuisance to the community.

Clearly, waste disposal control legislation in South Africa, although inadequate, appears to be in the process of being streamlined. In addition to the principles raised above, future policy and legislation must address the problem of the many disposal sites that are operating without permits and the widespread practice of illegal dumping. This can be achieved by the enactment of more stringent penalties and more effective monitoring of compliance.

### **Regulation of new industrial projects by environmental law**

The environmental media-based pollution legislation outlined above deals with general environmental pollution and its control. There is also a set of legal or administrative instruments designed to control the environmental impacts, in a more holistic sense, of new developments.

#### **Environmental impact assessments**

Environmental impact assessment involves the evaluation of the consequences of a proposed development for the environment. Developments may include the construction of roads, dams and factories and should also apply to the establishment of townships, industrial areas and recreation facilities. The environment to be considered is not only the natural environment but also the built environments in which people live and work. The purpose of an environmental impact assessment is to provide a methodology for the formal incorporation of environmental concerns into the decision-making process. It is, therefore, a decision-making tool but is not intended to make the decision and, therefore, has to be situated within a decision-making process.

Section 21 of the Environment Conservation Act of 1989 authorises the Minister of Environmental Affairs to identify activities which in his/her opinion may have a substantial detrimental effect on the environment. Section 22(1) of the Act prohibits the undertaking of an identified activity, except by virtue of a written authorisation issued by the minister, an administrator or a local authority or an officer designated by the minister. Section 22(2) provides that authorisation shall be issued only after consideration of reports concerning the impact of the proposed activity and of alternative proposed activities on the environments. Such report is to be submitted by such persons and in such a manner as may be prescribed.

On 4 March 1994 the minister published for comment proposed regulations concerning environmental impact assessment reports and a list of activities identified in terms of section 21. These regulations were, however, never promulgated, due to comments received and the lack of clarity regarding what the role of the national department and the provinces would be in managing the environmental impact assessment process.

At the time of writing the legal position, therefore, is that environmental impact assessments are not mandatory. It is, however, likely that provincial legislatures will introduce their own legislation in this regard in the near future. In the meantime some developers are already voluntarily undertaking the integrated environmental management procedure recommended by the Department of Environmental Affairs and Tourism.

### **The integrated environmental management procedure**

In 1984 the Council for the Environment established a committee to investigate the desirability of introducing environmental impact assessment requirements in South Africa. In 1989 the committee published a proposal for the introduction of a procedure called integrated environmental management in terms of which an environmental impact assessment would be required for all developments which may have a significant impact of the environment. In 1992 the Department of Environmental Affairs published a revised guideline document on the integrated environmental management procedure.

The integrated environmental management procedure is intended to ensure that environmental concerns are taken into account in all developmental action, from the planning of a project through to the decommissioning. The integrated environmental management procedure is based on a broad definition of the term "environment" and encompasses social, economic, cultural and aesthetic issues as well as the ecological impacts of a development. The process is also designed to include public participation and to facilitate participation by the public in decision-making. The guidelines for the presentation of the final report also make it clear that the environmental assessment and its conclusions need to be presented in such a way as to be understandable by the people who are potentially affected by an action or development. Therefore, the principles of informed decision-making, access to information, accountability for decisions taken and the public monitoring of compliance are all embedded in the procedure.

The first step of an integrated environmental management procedure is taken at a proposal development stage where all interested and affected parties need to be notified, the relevant authorities consulted, and issues of concern and alternatives identified. The second step involves the classification of the proposal into either having no significant impact, or potentially having some environmental impact. If the project may have an impact an initial assessment is done to determine whether potential impacts are serious enough to be classified as significant impacts. It may be clear from the start that there will be significant impacts. In either event, the next step is a formal environmental impact assessment which involves an extensive scoping or public consultation process and an environmental investigation.

The scoping process is probably the most important, controversial and difficult part of the procedure as it involves thorough and sincere consultation with all interested and affected parties. For the environmental impact assessment to be adequate, the views of these parties and their inputs into the decision need to be considered. The developer is expected to bear the costs of such a process as well, which may be fairly substantial depending on the scope and nature of the development. Particular attention is paid in the integrated environmental management procedure to ensuring the participation of historically disadvantaged communities.

Following from the environmental impact assessment there is an "authority review" of the assessment. This review should satisfy the relevant authority that sufficient information is provided in order to make a decision, that sufficient consultation with interested and affected parties has taken place and that the proposal complies with official requirements. The authority may then set conditions of approval which stipulate certain mitigating measures or other conditions, such as continual monitoring of impacts. A record of decisions, which is available on request to interested parties, must then be made available, something which would also apply in the event of the project not being approved. There is allowance for an appeal procedure from both the proponent and opponents of the development; however, the precise nature of this procedure is not yet clear.

The implementation of a project which has gone through a thorough integrated environmental management procedure may well be different from that initially conceptualised. An environmental management plan will probably be drawn up which will describe the implementation of the proposal and the control over this implementation. This will include the methods of management and monitoring of impacts, rehabilitation, mitigation measures, the maximisation of positive impacts and other relevant issues. The document will be a comprehensive plan describing the environmental management of the project from the start, through the life of the project and, finally, through the decommissioning stage.

A monitoring programme should be set up in the case of all approved proposals. This should assess whether the project is going as intended, whether there is compliance with the conditions set down and whether predictions of impacts were accurate.

One omission from the procedure is that it allows the developer not to undertake the public scoping and consultation aspects of the project if the nature of the project is confidential. No definition of "confidential" is given, which provides a loophole for the avoidance of a major part of the process.

The integrated environmental management procedure merely provides a procedural method for developers to follow. It does not provide answers to the measure of what a "significant" impact is or how to reconcile differing views on "significance". The procedure further does not provide a methodology of weighing up environmental costs and benefits against each other. Thus, integrated environmental management will not on its own, even if thoroughly implemented, resolve conflicts around environmental issues or provide insights into the "correct" environmental approach to a development.

### **Decision-making in a context of regulatory uncertainty**

In the absence of clear policy directions and *ad hoc* enforcement strategies by government, the extent to which South African industry incorporates environmental considerations into decision-making is widely divergent. This is illustrated by the different approaches corporations have to undertaking environmental impact assessments. Although environmental impact assessments are not mandatory, numerous large corporations routinely undertake environmental impact assessment while others, particularly small and medium-sized enterprises do not perform environmental impact assessments unless it is a requirement of a permit application. Even within corporations themselves there are differ-

ent approaches for different projects, notwithstanding a general commitment to undertake environmental impact assessments. For example, an internal environmental impact assessment may be done which does not involve any public participation. This may be done as one of the initial project appraisal activities or as part of the final decision before the development is commissioned. Other environmental impact assessments clearly may involve extensive public consultation.

The extent to which environmental considerations influence industrial decisions is further determined by whether the project is a new or "greenfield" project or an extension to an existing facility. There appears to be a perception among many industries that performing environmental impact assessments for extensions or changes to existing facilities is unnecessary. On the other hand, there also appears to be a general understanding in industry that "greenfield" projects require the undertaking of environmental impact assessments which involve the public. The issue is also directly related to the project's visibility. A high-profile project on a new site is likely to get more public reaction than a project which involves changes to an existing facility. It appears that the more likelihood there is of public reaction, the more likely it is that an environmental impact assessment will be performed.

The lack of clear regulatory requirements makes it extremely difficult for industry to synchronise its industrial planning with a consistent environmental policy framework. The complexities involved in determining environmental requirements from disparate authorities often prompts industry, particularly small and medium-sized enterprises which do not have the resources to be proactive, to proceed with the development and to face any administrative or legal obstacles as and when they arise. This approach stems more often from a lack of knowledge of permitting or other administrative requirements than from deliberate attempts to evade environmental responsibility.

### **The importance of environmental factors in industrial decision-making**

Risking allegations of reductionism, it is submitted that the relative importance of environmental considerations in industrial decision-making is determined primarily by considerations of potential liability or negative publicity that may result from environmentally detrimental activities. Environmental considerations are generally not so much a part of industry's production strategy as of its risk strategy. The risk of legal liability and direct prosecution is, however, relatively insignificant. As discussed, South African environmental law has been inadequately enforced.

Those industries that have introduced environmental controls in their operations have generally done so because they envisage that, in addition to the avoidance of legal liability, other benefits will be derived through the incorporation of environmental factors into decision-making. Such benefits include avoiding potentially controversial projects, particularly in the light of South Africa's increased exposure to international markets. As local industries began entering foreign markets, they have been under pressure to take a more proactive environmental approach (see Bethlehem in this volume). This is particularly evident in the operations of international subsidiaries based in South Africa. The increasing number of due diligence appraisals being performed by South African law firms and environmental consultants is testimony to the increasing awareness of the threat of potential liability in this regard.

## The way forward

We suggest that the limited ability of South African environmental law to influence industrial decision-making is both the result of a lack of administrative or procedural certainty and the result of shortcomings in the body of environmental law itself. The law needs to be improved, as well as more decisively and effectively administered.

The finalisation of a clear environmental management policy, envisaged by the consultative national environmental policy process, will provide the framework within which consistent management practices and enforcement strategies can develop. It is only once these practices and strategies are in place that industry will be able to synchronise its strategies with broader environmental management goals.

To influence industrial decision-making, environmental management policy must provide certainty in two crucial areas. First, it must provide operational certainty. In embarking on a new project or extending an existing one, industry must be aware of the legal requirements it must fulfil and must be assured of efficient decision-making and implementation of the law by the authority concerned. Rationalisation of environmental law and administration and control of environmental decision-making by a central government department would significantly assist in achieving the goal of operational certainty. Second, strategic certainty must be assured. Industry must be able to make planning decisions in line with a stable environmental policy framework which lays the basis for consistent enforcement strategies in the future.

Perhaps the single most important prerequisite for effective environmental management is to integrate environmental considerations into industrial planning processes. To some extent this may be achieved by the Development Facilitation Act. Although the principal purpose of the Act is to provide a fast-track mechanism for the release of land for development (on the basis that land is a prerequisite for any development), the Act facilitates the inclusion of environmental considerations in development decisions by requiring that in certain circumstances environmental impact assessments are to be performed as part of the preparation of performance criteria (essentially business plans for development at local level).

Following the example of the Act, legislation should be put in place making environmental impact assessments mandatory in all development projects, involving a set of certain defined processes or activities, including both "greenfield" developments and expansions of existing operations. Integration may be further assisted by government by the merging of planning departments with environmental departments at provincial and local level. Environmental criteria may then be taken into account when considering zoning applications, planning requirements and permitting procedures — effectively requiring industry to integrate environmental consideration into their strategic decisions. Liability should be imposed on non-compliance with environmental management requirements, since experience shows that it is the threat of substantial liability that has the most influence on industrial strategy. It is only through the use of such measures that environmental law will require industrial strategy to operate in tandem with broader environmental management policy goals.

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## chapter 2

# CHEAP ENERGY—AT WHAT COST?

## Externalities in South Africa's electricity sector

Clive van Horen

### Introduction

The electricity sector plays a central role in the South African economy as the supplier of a key input to the industrial, mining and commercial sectors, as an employer and as a service provider for households.<sup>1</sup> This role is likely to increase in the foreseeable future as the country's growth and development objectives translate into greater economic output and improved service levels for low-income households. Cheap electricity is widely viewed as an important basis for achieving these objectives. In this context it is pertinent to ask: How serious are the negative environmental impacts caused by electricity generation? What is their significance in economic terms? And what would it mean if those impacts were to be accounted for in the regulatory and pricing regimes? These are some of the questions addressed in this chapter.

To begin with, a brief overview is provided of South Africa's electricity supply industry. Next, reference is made briefly to the theory of externalities and methodologies for their valuation—some understanding of this is necessary for the subsequent analysis. The third section of this chapter summarises briefly the results of major international attempts to account for electricity sector externalities. In the fourth section, the main externalities in South Africa's electricity sector are identified, focusing especially on the coal-based subsector, but including aspects of the nuclear-based electricity industry. Thereafter, economic valuations of key externalities are made, and these results are compared to current price levels. The chapter ends by considering the limitations of the analysis, as well as several important policy implications.

<sup>1</sup> This chapter is based on a study undertaken as part of the Industrial Strategy Project, published as a book entitled *Counting the social costs: electricity and externalities in South Africa* (Van Horen 1996a).

## An overview of South Africa's electricity supply industry

South Africa's electricity supply industry comprises three main subsectors, corresponding to their functional activities: the generation of electricity, its transmission from power stations through a high-voltage national network and the distribution of electricity from the transmission network to end-consumers. While the focus of this chapter is primarily on the generation sector, it should be noted that there is an important new stakeholder in the electricity supply industry, namely, the National Electricity Regulator, which was established by government in early-1995 on the recommendation of the National Electrification Forum.<sup>2</sup> While the principal concern of the National Electricity Regulator is presently with matters related to the electrification programme, such as the issuing of licences to distributors and overseeing the rationalisation of the distribution industry, this is unlikely to be the case forever. As is the case in many countries with large electricity supply industries, it can be expected that the National Electricity Regulator's mandate will be widened to include also the governance of the environmental performance of the industry.

The key player in the electricity generation sector is Eskom, the national electricity utility. In 1994, Eskom generated 96% of all electricity in South Africa, with the balance being produced by some local authorities with their own power stations (such as Johannesburg, Port Elizabeth and Cape Town) and by private concerns producing electricity for their own consumption (Eskom 1995a: 54). Most of the municipal power stations are used as a backup to the Eskom supply, and have not been fully operational for some time, with the exception of those in Johannesburg, which have ready access to cheap coal (Steyn 1994: 7).<sup>3</sup> Given the dominance of Eskom in the electricity generation sector, therefore, the remainder of this chapter focuses on its own power stations. This is not to say that the environmental impacts of local authorities' power stations are less significant than those of Eskom—if anything, the opposite is true given that their stations are generally older, less efficient and located in more densely populated areas. Nonetheless, their size in relation to Eskom's capacity does not warrant further attention here.

As at the end of 1994, Eskom had a total of 19 power stations in commission, with a total nominal capacity of 37 840 megawatts (MW) (Eskom 1995a: 56). A breakdown of this capacity by fuel source is shown in Table 1.

It is evident from the table that 95% of total electricity capacity is based on non-renewable resources: primarily coal, but including also nuclear and small amounts of gas. The coal and nuclear power stations provide the bulk of the base electricity load, while the pumped storage schemes and gas turbines are used to meet electricity demand during peak times and in cases of emergency. Pumped storage schemes are net consumers of electricity, which is used during off-peak hours to pump water to storage reservoirs, and then allowed to run down during peak hours when electricity demand is especially high.

<sup>2</sup> The National Electrification Forum was a body representing all key stakeholders in the electricity industry, established in 1993 to formulate policies for an accelerated electrification programme for South Africa. It was disbanded in early 1995, having reached agreement on some issues, but since it could make decisions only by consensus, its ability to resolve important policy questions was constrained.

<sup>3</sup> The Cape Town electricity department recommissioned its Athlone Power station in 1995 for the purpose of meeting peak demand.

**TABLE 1** Breakdown of Eskom's generation capacity as at 31 December 1994  
 (Eskom 1995a: 56)

	Number of stations	Location	Nominal capacity (MW)	% of total
Coal-fired	12	Mpumalanga (10), Free State, Northern Province	33 568	88,7
Nuclear	1	Western Cape	1 930	5,1
Gas turbine	2	Western Cape, Eastern Cape	342	0,9
Hydroelectric	2	Free State	600	1,6
Pumped storage	2	KwaZulu-Natal, Western Cape	1 400	3,7
Total	19		37 840	100,0

Of the total capacity of 37 840 MW, some 4 531 MW, or 12%, was mothballed as at the end of 1994 (*ibid.*: 56), because of the excess capacity of the Eskom system—these were generally the older and less efficient stations. Peak demand in 1994, which occurred on the night of 26 July, was 24 798 MW (*ibid.*: 2), reflecting the large amount of excess capacity, even with the standard reserve margins commonly employed by utilities. In 1995, however, the peak demand on the system came much closer to supply capacity.

The dominance of coal in the production of electricity is even more significant, with coal-fired power stations accounting for 92% of all electricity generated in 1994—this higher percentage, relative to their share of total capacity, reflects the high level of utilisation of coal plants which are used for base-load. The Koeberg nuclear power station has supplied a relatively constant 5% to 6% of Eskom's electricity. While the contribution of the two pumped storage schemes has been fairly constant at around only 1%, the amount of electricity generated by the hydroelectric schemes dropped considerably in 1992 and 1993; this was due to the drought which affected the flow rate of the Orange River.

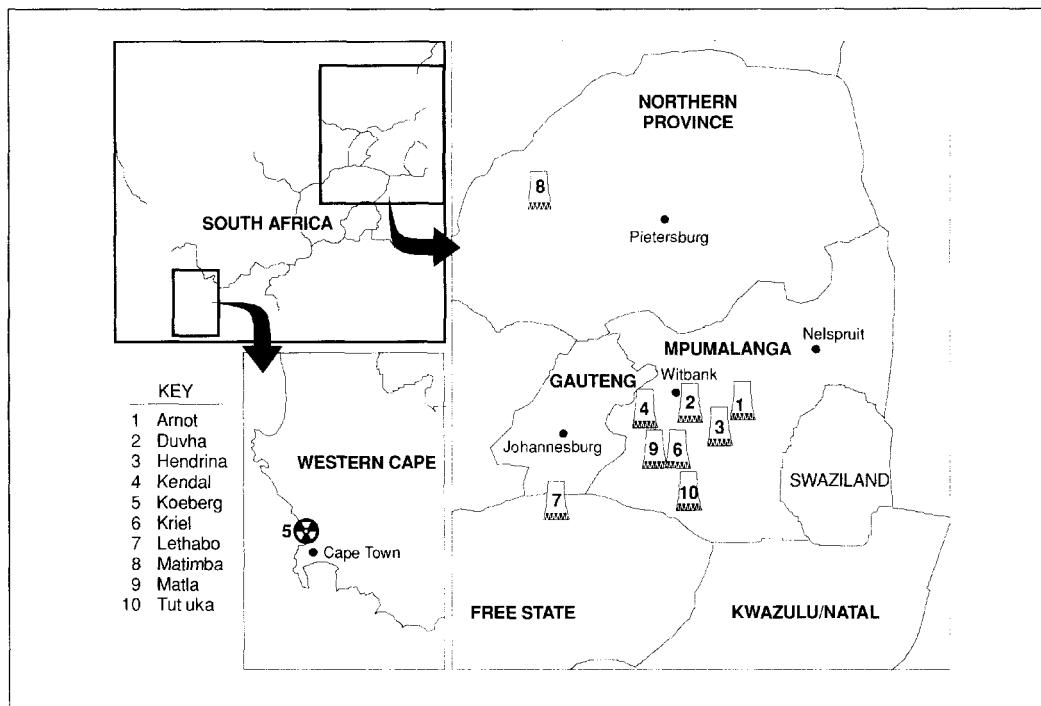
Eskom operated nine of its coal power stations during 1994; their location and that of Koeberg nuclear power station is shown in Figure 1.

### **Eskom in an international context**

Eskom is one of the largest electricity utilities in the world. As shown in Table 2, it ranks among the top five utilities, measured on the basis either of capacity or of sales. Interestingly, Eskom is one of only two utilities from non-Organisation for Economic Cooperation and Development countries, the other being South Korea's Korea Electric Power Company. This makes South Africa the country with the lowest per capita GDP of the countries shown in the table (World Bank 1993). Eskom is, therefore, an unusually strong utility among developing countries.

Another important point of comparison between Eskom and international electricity utilities is their relative price levels. Here, Eskom ranks among the cheapest producers

**FIGURE 1** Location of Eskom's operational coal and nuclear power stations, 1994



in the world.<sup>4</sup> At the end of 1993, its industrial electricity tariffs were the lowest of a basket of industrialised countries: Japan (whose average price was over three times higher than Eskom's), Germany, the UK, the USA, France, Canada, New Zealand and Sweden (Eskom 1995a: 9). This comparison is all the more striking when the resource bases of some of those countries are taken into account: in particular, several of the listed countries are predominantly hydro-electricity based, which is generally regarded as one of the cheapest sources of electricity (when compared to coal, gas, nuclear, etc.). This comparison, therefore, begs the question: why is South Africa's electricity so cheap in relative terms?

### Trends in Eskom's electricity prices

A notable development in relation to Eskom's electricity prices is its ongoing commitment to reduce the real price of electricity on the back of internal efficiency gains. Eskom announced its "price compact" in 1991, in terms of which it undertook to decrease the real price of electricity by 20% over the five-year period 1992 to 1996. This came on top of a 14% reduction in real price which had already been achieved from 1987 to 1991 (Eskom 1992: 5). In 1994, it made a further commitment, in terms of its so-called "RDP commitments" to

<sup>4</sup> This comparison excludes utilities whose tariffs are too low to recover their costs.

**TABLE 2** The largest electricity utilities in the world in 1993 (Eskom 1995a: 59)<sup>5</sup>

Utility	Country	Annual sales (gigawatt-hour—GWh)	Ranking by sales	Nominal capacity (MW)	Ranking by capacity
EDF	France	372 400	1	98 100	1
TEPCO	Japan	231 665	2	49 492	3
ENEL	Italy	197 451	3	50 888	2
Hydro-Quebec	Canada	152 099	4	29 131	7
<b>Eskom</b>	<b>South Africa</b>	<b>143 800</b>	<b>5</b>	<b>39 746</b>	<b>4</b>
Ontario Hydro	Canada	127 777	6	33 793	6
Korea Electric Power Co.	South Korea	127 734	7	27 654	8
Kansai Electric Power Co.	Japan	123 300	8	35 035	5
RWE	Germany	121 504	9	25 777	9
TVA	USA	118 560	10	25 622	10

reduce the real price by 15% over the period 1995 to 2000 (Eskom 1995a: 9). Until 1994, all of these targets had been met and, therefore, 1994 prices were approximately 76% of 1987 levels in real terms. There is little reason to believe that the utility will not meet its latest commitment and, if this is the case, the average electricity price in 2000 will be approximately 60%, in real terms, of the 1987 price level (Van Horen 1996b). This is a dramatic decrease by any standards.

Eskom suggests that these price reductions will be achieved through ongoing productivity improvements, reduced operating expenditure and cost containment. This commitment is linked to the goal of becoming "the world's lowest-cost producer of electricity" (Eskom 1995a: 3). It is evident that other factors underlie this decrease in electricity prices, notably the decrease in the number of employees, from 66 000 in 1985 to 40 000 in 1994 (*ibid*: 55). In addition, its reduced exposure to finance charges has contributed significantly to its financial health, with the debt-equity ratio declining from 3,0:1 in 1985 to its 1994 level of 1,7:1 (*ibid*: 10). The utility's stated intention is to reduce this ratio to parity by 1998. This is achievable given that its levels of capital expenditure have declined considerably in real terms since the mid-1980s because of the situation of over-capacity in which Eskom found itself (Van Horen 1996b).

It is in this context that the question again arises whether South Africa's electricity prices, which are declining in real terms, adequately reflect environmental costs. Before investigating international and South African experience with external costs, the following section reviews briefly the economic theory of externalities.

<sup>5</sup> All data as at 31 December 1993, except for TEPCO (31 March 1994), ENEL (31 December 1992), RWE (30 June 1993) and TVA (30 September 1993).

## Theoretical and methodological issues

There is a large body of economic literature which deals with the theory of externalities and market failure. It is important to understand this theory because of the complex methodological questions which arise in attempts to apply it. This section therefore briefly reviews the theory of externalities.<sup>6</sup>

A central concept in the economic analysis of environmental impacts is that of an *externality*. An externality or, “external effect”, can be either positive or negative, although policy is most frequently concerned with the latter because of the implied welfare loss. In its earlier usage, the term was sometimes defined so broadly as to include most sources of market failure (Mishan 1971: 6, Baumol and Oates 1975: 16), although in its more contemporary usage it generally refers to a situation where two conditions are met:

- activity by one economic agent causes a change in the utility or welfare of another agent, (more formally, the first entity’s production function includes variables whose values are determined by the second entity); and
- this change in welfare is not compensated or appropriated (Baumol and Oates 1975: 17, Pearce and Turner 1990: 61).

An externality, therefore, arises in situations such as where a productive facility causes the emission of pollutants or waste products which, in turn, impact upon human health or environmental elements which have value for humans (such as agricultural crops), where the costs of those impacts are not captured in the market relationship between the producer and its customers, and those who bear the costs are not compensated in any way. It is apparent that this scenario applies to the production of electricity in so far as it results in environmental and health impacts, the costs of which are not accounted for in the utility’s costing or pricing structures.

Another way of explaining the idea of externalities is by reference to the divergence between private and social costs (Pearce and Turner 1990: 66). Private costs are those costs which are borne by the producer of the good—in Eskom’s case, these comprise the costs of the factors of production: coal, enriched uranium, labour, capital and so on. Social costs go further than this to include the full costs of producing or consuming a commodity, and may be borne not only by the producer but also by other groups in society at large. The difference between private and social costs, then, represents the external cost or the externality which is borne by society at large.

The principles of external costs are illustrated graphically in Figure 2. Any individual producer faces a horizontal marginal revenue curve (shown by MR) equivalent to the price of the commodity, and a marginal private cost curve (shown by MPC). If the producer seeks to maximise its surplus, it will clearly produce at the point where its marginal revenues and costs are equal—point B, that is, at a level of output equal to  $Q_1$ . With the assumption that it seeks to maximise profits, it makes little sense to deviate to either side of that point. The marginal external cost at any given level of output is given by the vertical difference

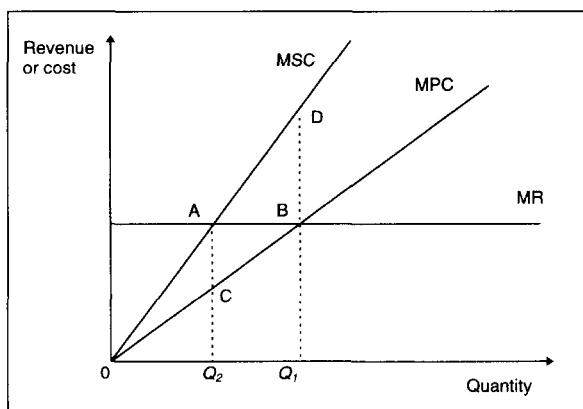
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<sup>6</sup> One of the classic texts dealing with externalities is Baumol and Oates (1975). For a more accessible text see Pearce and Turner (1990).

between the marginal social cost (MSC) and MPC lines, and so the total external cost at the individual's optimum ( $Q_1$ ) is equal to the triangle OBD.

While this may be optimal from the individual producer's perspective, it is not ideal for society as a whole. The socially optimum level of output will be at a lower point, that is, point A, where the marginal benefit equals the marginal social cost, equivalent to a level of output of  $Q_2$ . At this point, the benefits to society are exactly equal to the costs to society of producing the commodity, and so, if the objective is to maximise social welfare, rather than individuals' surpluses, then it does not make sense to deviate to either side of  $Q_2$ .

**FIGURE 2** Illustrative marginal revenue (MR), marginal private cost (MPC) and marginal social cost (MSC) curves in a competitive market



It is worth noting that in terms of this formulation, which is derived from basic microeconomics, the economic optimum will still be associated with some level of pollution, the external costs of which are shown by the triangle OAC in the figure. This is an important point of departure in economic analysis, namely, that there is an optimal level of pollution, which is often above zero, and that this depends upon the interplay between costs and benefits. In an environmental analysis, by contrast, the optimum level of pollution is usually at or close to zero, corresponding to very low levels of economic activity, depending not on costs and benefits, but upon ecological processes. This highlights the frequently differing approaches of economists and environmentalists in analysing pollution and related issues.

The theory as outlined above, therefore, demonstrates that externalities constitute an important source of market failure. If the above conceptual representation bears any relation to reality, then it can be expected that the existence of externalities may lead to several outcomes which are less than ideal. Firstly, resources could be allocated inefficiently due to the decision of producers to produce a higher level of output than is economically ideal. Secondly, the burdens of the external costs are seldom spread equitably across society and often fall on social groups which are least able to afford them. Thirdly, a higher rate of productive activity usually translates into more rapid consumption of resources, includ-

ing non-renewable ones, and this undermines goals of environmental sustainability. Collectively, the effect of externalities is, therefore, in conflict with the goals of economic efficiency, social equity and environmental sustainability—the three pillars upon which “sustainable development” is based.

### **Externality valuation: methodological issues**

Two sets of methodological issues are relevant to the measurement of externalities in practice: the overall framework for identifying externalities, and the methods used to value them in economic terms.

Given that there is a wide range of environmental impacts arising from the generation of electricity, it is necessary to adopt a systematic approach to their identification and evaluation. The method used in this study, which has been used in the majority of international externalities studies, is the impact pathway or damage function approach. This approach is illustrated conceptually in Figure 3.

The damage function approach entails the identification and quantification of environmental and other damages arising at each stage in the fuel cycle: from the extraction of raw materials (such as coal or uranium), to their transport and processing, to their consumption in power stations, to the impacts of waste products arising in the electricity generation process, and their impacts on human health and amenity, and on the physical and natural environments.

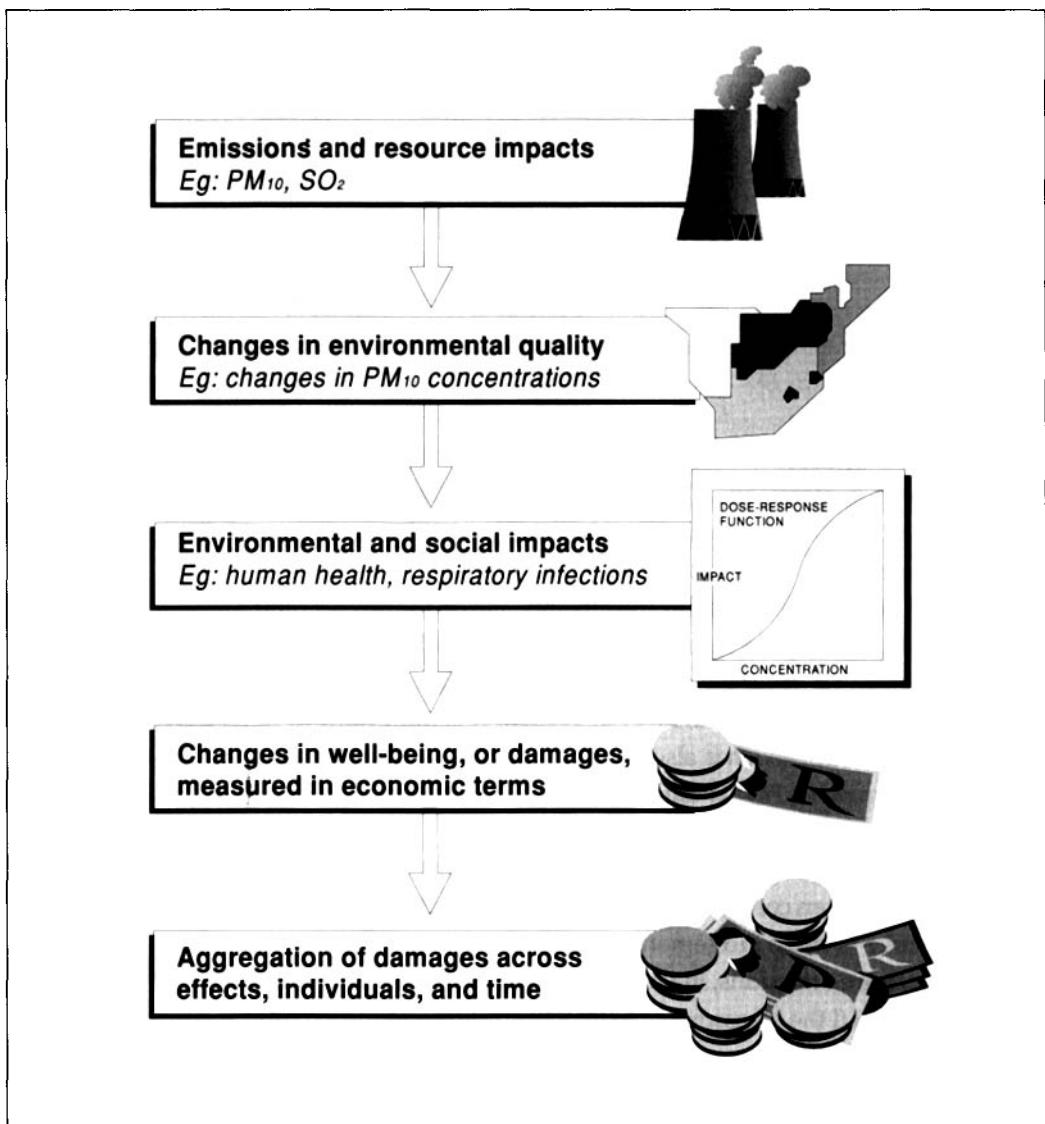
This approach corresponds with the real-world steps in the fuel cycle. The damage function approach is generally regarded as the preferred approach to assessing environmental externalities in practice (Rowe et al 1995:2). It is important to note, however, that the damage function approach is also subject to several weaknesses and limitations:

- the approach is highly data-intensive, since information is required about each step in the impact pathway;
- professional judgements are required about the most appropriate data to use, since there are often conflicting views in the externalities literature, and the result can be sensitive to these judgements;
- if there are omissions, inaccuracies or biases in the data, these can be compounded throughout the assessment chain, thereby limiting the usefulness of the end results; and
- the damage function approach is fairly complex and draws upon a number of disciplines, which can render such studies inaccessible to the wider audience which may be interested in their results.

While the data requirements of a comprehensive impact pathway assessment are formidable, there is a relatively large body of relevant information which makes it possible to employ the approach in South Africa.

A further important characteristic of the damage function approach is that it allows for the analysis to proceed as far down the impact chain as the decision-maker chooses. Thus, for instance, if there is uncertainty or disagreement over the valuation of human health effects or crop damages from air pollution, it is possible to use the information about physical impacts as the basis for decision-making; in other words, it is entirely possible to stop short of the economic valuation of externalities if the decision-maker chooses. Moreover, provided these

**FIGURE 3** The damage function approach for power station emissions  
(after Rowe et al 1995:3)



input assumptions are made explicit, it is possible for users to perform sensitivity analyses or enter alternative values for particular variables.

In order to make estimates of the value of the externalities identified in this chapter, it is important to describe briefly the valuation approach which has been used in respect of changes in human morbidity and mortality.

A number of valuation approaches exist to value morbidity and mortality. Dealing first with morbidity, two broad methods can be used: first, those based on individual preferences, that is, willingness to pay for environmental and health improvements, or willingness to accept compensation for deterioration and, second, those methods based on

resource or opportunity costs (Freeman 1993:343). There is a considerable body of literature around these methods, which is summarised briefly in Van Horen (1996a). For present purposes, it can be noted that the second approach, sometimes also called the "cost of illness" approach is used in this study, for the main reasons that willingness to pay and willingness to accept compensation studies have not been undertaken yet in South Africa and, in any event, these approaches are more complex and controversial in the context of a developing country such as South Africa. Thus, the valuation of health effects generally includes actual expenditure on health care (both public and private), transport costs, medication and foregone income, such as lost time at work. This data has been derived from published medical data wherever possible, otherwise from estimates by public health practitioners.

Turning to the valuation of premature death, the complexities and controversies are significant. Not least of all is the ethical problem which arises in reducing human life to a finite monetary value, and the implications this holds for policy-making. The economics literature frequently makes a distinction between the valuation of an individual's life and the value individuals or society place on the risk or probability of early mortality (Freeman 1993, Pearce et al 1991:5).

Another, perhaps more compelling, justification for undertaking valuation is that in many respects this is done already by individuals and society implicitly in many of their activities, but often without making the trade-offs explicit. This is acutely evident, for example, in the decision over the allocation of public resources to primary health care services versus high-level tertiary care such as heart transplants. To assign some monetary value to human life merely makes transparent or explicit whatever judgements are being made. Furthermore, provided the values are used in a decision-making context which seeks to balance the full range of interests as best as possible, the use of monetary values for early death can serve an important strategic purpose: for example, by highlighting the losses suffered by society due to inadequate supplies of potable water and sanitation services, a case can be made, perhaps more strongly, for investment in improved service levels.

As in the case of morbidity effects, there are a number of methods which may be adopted to value premature death. One is the "human capital" approach: essentially, this entails valuing a lost life at the discounted value of future income which that person might have been expected to generate. Most simply, average GDP would be used as a proxy for that person's income: this was done, for instance, in a study by Dutkiewicz and de Villiers (1993). Problems soon arise, however, particularly if there is any differentiation between social classes, age groups, males and females, employed and unemployed, and so on—the implications of the differing values which result are especially problematic for policy and resource allocation decisions where "equity" is a goal: in most societies, adult males of about 25 years of age will have the highest "value" (Freeman 1993:324). Furthermore, this approach is highly sensitive to the choice of a discount rate: for example, for a male child between one and four years of age in the US in 1987, at a discount rate of 2,5%, its human capital value would have been \$761 000, compared to only \$60 000 at a discount rate of 10% (*ibid*: 325).

The valuation approach which is generally preferred in the literature entails the use of individual preference approaches: not so much a person's willingness to pay to avoid

death (which would probably be their entire wealth) or willingness to accept compensation for death (which would probably be an infinite amount), but the valuation of a changed probability of death. Such decisions are made on a daily basis: for example, in paying a higher price for a ticket with an airline or bus service which is considered safer than the alternatives.

The choice of values of premature death for South Africa is made difficult by two factors: first, there have been no studies of this nature in this country from which values can be derived; second, there are sharp inequalities in the distribution of income and wealth, which presents problems (from an equity perspective) if differential valuations are used for different income groups—as would apply if the human capital approach was adopted.

Taking both of these issues into account, this study uses a consistent valuation set for premature death across the entire population in the region. The valuation approach adopted here has drawn on international studies of revealed preference, adjusted to take account of differential levels of income. At least two major international externality valuation exercises have undertaken their own reviews of the literature and, on that basis, selected a range of values for premature deaths. These estimates, which are based on revealed preference approaches, are shown in Table 3. The study by Rowe et al (1993, 1994) was undertaken for New York state, USA, and drew upon North American valuation studies; likewise, the study by ETSU (1995) estimated values for the European Union.

Simply applying these valuations to South African conditions would be problematic from a theoretical perspective, since individual valuations of the risk of death must, by definition, take some account of income levels. Assuming these valuations vary in direct proportion to income, an adjustment can be made to the North American and European values to reflect average South African income levels. These adjustment factors are also shown in Table 3.

The figures in the bottom right cell of Table 3 represent the average of the adjusted valuations for the American and European studies in the last row of the table. If these numbers are rounded to the nearest R100 000, the following valuations for premature deaths are derived:

- low estimate: R700 000;
- central estimate: R1 000 000; and
- high estimate R1 400 000.

These are the values which have been used in this study for purposes of attaching an economic value to premature mortality. The final consideration for present purposes concerns the possible differentiation of valuations depending on variables such as age, gender, race and location. While the use of different valuations might yield results which more accurately reflect the influence of these variables on the economic standing of individuals, this is not done in this study, for the following reasons:

- the empirical basis for introducing a wider range of valuations for different social groups, is weak. The only method would involve adjusting the above estimates for average incomes of each group being identified (in the same way as this was done in Table 3). However, this would introduce the same problems as are attributable to the human capital valuation approach—particularly the ethical and equity considerations arising in policy decisions encompassing different social groups;<sup>9</sup>

**TABLE 3** Valuations of premature deaths used in international studies and in this study

	USA	European Union	South Africa
GDP per capita (\$ 1992)	23 240 (World Bank 1995: 163)	19 678 (calculated from World Bank 1995: 163)	1 680 <sup>7</sup>
Income adjustment factor	13,8	11,7	1
Mortality valuations	Rowe et al (1994:X-14)	ETSU (1995: 49)	
- Low estimate	\$1 700 000	ECU 2 100 000	-
- Central estimate	\$3 300 000	ECU 2 600 000	-
- High estimate	\$6 600 000	ECU 3 000 000	-
Income-adjusted valuations (1995 R) <sup>8</sup>			Average:
- low estimate	450 042	857 493	653 768
- central estimate	873 612	1 061 659	967 635
- high estimate	1 747 224	1 224 991	1 436 107

- the modelling of health outcomes does not permit differentiation between, for example, employed and unemployed victims of pollution. Thus it would not be possible to apply differentiated valuation sets for the range of externalities being considered in this thesis; and
- the marginal increase in “accuracy” which might be achieved through further disaggregation of the above valuation sets, would require a disproportionately large increase in data collection and modelling sophistication.

### **Externality valuation: The international experience**

Distinguishing features of the environmental costs produced by externality studies undertaken to date are the numerical discrepancies and lack of consistency in their results. This uncertainty is sometimes used by sceptics to discount altogether the validity of such attempts. This, however, is an unconstructive and uncritical response since many of the dif-

<sup>7</sup> Calculated as follows: GDP for 1992 of R238 711 million (SAIRR 1995: 380), divided by population estimate for 1992 of 38,8 million (1994 estimate of 40,7 million, reduced by annual growth rate of 2,44%) (*ibid*: 5).

<sup>8</sup> The US and EU valuations are divided by the income adjustment factor to give South African valuations. The following exchange rates are used: \$1 = R3,66, ecu 1 = R4,78.

<sup>9</sup> Because such comparisons are not being made on an international scale in this study (for example, between South African externalities and those elsewhere), there is no contradiction in adjusting international valuations to reflect different income levels in South Africa, as per Table 3.

ferences can be accounted for by the varying technical and environmental conditions pertaining to the studies, as well as to methodological differences. The estimates of external environmental costs produced by nine significant studies are summarised in Table 4.<sup>10</sup>

For purposes of this study, the most important fuel cycles are coal and, secondarily, nuclear; nonetheless, it is interesting to compare the external costs of these cycles with others, which becomes especially relevant when making decisions about new investments with various resource options. As would be expected, renewable options fare much better than fossil fuel and nuclear fuel cycles, with large relative differences in external costs. Of all fuel cycles, coal had the consistently highest external cost, with the exception of nuclear in Hohmeyer's study and oil in Pearce's study.

Upon closer inspection of externalities in the coal cycle, it is apparent that the studies can be grouped into two categories, based on the order of magnitude of their results. The first group comprises the three earlier studies—Hohmeyer, Ottinger and Pearce—which produced external cost estimates in the range of 7,3 c/kWh to 33,1 c/kWh. The second group of studies, which were all conducted post-1992, produced lower estimates, in the range of 0,21 c/kWh to 9,52 c/kWh. In analysing the differences in these studies, the following main factors may be identified (partly drawn from Lee 1995: 2-3):

- ***Methodology.*** While all the studies summarised in the table used the damage cost approach, they used different methods to obtain data on components in the impact pathway. The earlier studies generally used other studies' estimates of pollution emissions and impacts, and multiplied these by economic values to calculate damage costs. The second group of studies, on the other hand, either used more complex and specific methods to collect data on pollution emissions, dispersion and impacts, such as atmospheric models and dose-response functions, or they used lower valuations. In practice, the effect has been that the earlier studies used higher estimates of emissions, concentrations and impacts.
- ***Emission factors.*** The earlier studies' emissions factors (measured in tonnes of pollutant per gigawatt-hour of electricity generated) were considerably higher than in recent studies, sometimes by a factor of 10. This is partly due to technical differences in the plants which were addressed, in that more recent studies have selected newer plants which have better environmental performance in general and, in some specific cases, are fitted with desulphurisation and other control equipment.
- ***Sulphate and nitrate aerosols.*** The older studies contain different assumptions about emissions of SO<sub>2</sub> (from which damaging sulphate aerosols are formed) and about their dispersion in the atmosphere, which lead to higher external cost valuations. SO<sub>2</sub>-related externalities accounted for 60% of total externalities in Ottinger et al's work, and 75% in Hohmeyer's study, both of which are considerably higher than the more recent studies.
- ***Climate change damages.*** In earlier studies, fairly high values were attributed to damages caused by climate change (impacts include, for example, sea level rise, increased drought and climatic extremes), whereas in more recent studies, analysts have argued

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<sup>10</sup> For more details on each of these studies, see Van Horen (1996a).

**TABLE 4** Fuel cycle external costs (in cents per kilowatt-hour—c/kWh) estimated by various studies (adapted from Lee 1995: 5; Friedrich and Voss 1993: 121, Dutkiewicz and de Villiers 1993: 41, Schlesisner et al 1995)

STUDY	FUEL CYCLES							
	Coal	Nuclear	Gas	Oil	Hydro	Solar	Wind	
Hohmeyer (1988)	14,49 to 33,05	36,45 to 77,96	14,49 to 33,05	14,49 to 33,05	no estimate	+25,51 to +64,05 <sup>1</sup>	+21,01 to +46,12 <sup>2</sup>	
Ottinger et al (1991)	24,67	12,33	5,12	11,49 to 28,51	no estimate	0 to 1,70	0 to 0.42	
Pearce et al (1992)	7,25 to 30,71 <sup>3</sup>	0,31 to 1,84 <sup>4</sup>	2,33	34,11	0,25	0,43	0,25	
Friedrich & Voss (1993) <sup>5</sup>	0,87 to 4,65	0,06 to 1,35	no estimate	no estimate	no estimate	0,16 to 2,69	0,08 to 0,83	
Dutkiewicz & de Villiers (1993) <sup>6</sup>	0,93	0,26 to 0,80	no estimate	no estimate	no estimate	0,01 to 0,05	0,01 to 0,04	
ORNL/RFF (1994a,b; 1995a-e)	0,21 0,47 <sup>7</sup>	0,08 0,12	0,00 0,08	0,06 0,08	0 0,06 <sup>8</sup>	no estimate	no estimate	
ExternE (ETSU 1995)	3,24 7,94 <sup>9</sup>	0,05 1,31 <sup>10</sup>	0,38	6,26	1,20 <sup>11</sup>	no estimate	0,57 to 1,20 <sup>12</sup>	
RCG/Tellus (Rowe et al 1995)	1,01 <sup>13</sup>	0,04 <sup>14</sup>	0,08	0,54	no estimate	no estimate	0,00	
Schlesisner et al (1995)	0,73 to 9,52 <sup>15</sup>	no estimate	no estimate	no estimate	no estimate	no estimate	0,07 to 0,73	

#### Notes

<sup>1</sup> All amounts in 1994 SA c/kWh, converted from 1994 US cents at a rate of R3,66/\$1, and from 1993 German mark at R1,98/DM1. Where relevant, amounts in rand have been adjusted using a 10% annual inflation factor.

<sup>2</sup> + denotes an external benefit.

<sup>3</sup> Estimates for a "new" and "old" plant respectively.

<sup>4</sup> High estimate reflects risk averse valuation of health impacts of nuclear disaster.

<sup>5</sup> Estimates are for 4 000 full load hours per year, and include external costs of back-up system.

<sup>6</sup> Estimates originally in 1989 rand; annual adjustment of 10% used.

<sup>7</sup> Estimates for plants in the rural south-west and south-east USA respectively.

<sup>8</sup> Estimates for retrofit on existing dams in Kentucky, and diversion project in Washington State, respectively.

<sup>9</sup> All but 0,02 c/kWh was due to the aesthetic value of a waterfall, which was estimated in a contingent valuation study.

<sup>10</sup> Estimates using a 3% and 0% discount rate respectively.

<sup>11</sup> The first estimate was for a site at West Burton, UK; the second was for Laufen, Germany.

<sup>12</sup> Estimates for various sites in the UK.

<sup>13</sup> Estimates are for a rural site in New York State.

<sup>14</sup> For a boiling water reactor, rather than pressurised water reactor.

<sup>15</sup> Estimates are for a "conventional coal-fired plant" defined as a 350 MW plant with desulphurisation and de-NO<sub>x</sub> equipment.

that there is too much scientific uncertainty about the impacts of climate change (without questioning its likelihood of occurring) to make meaningful estimates of damage costs. Recent studies have, in turn, been criticised for understating the likely scale of those impacts by avoiding their valuation (Ottinger 1995: 4).

If any conclusions are to be drawn from these international studies, then the first would be that external costs *can be* significant in absolute terms, as well as in relative terms, when comparing alternative fuel cycles. International experience, therefore, points to the need to investigate externalities in South Africa's power sector. Secondly, it is important not to take external costs simply at face value; rather, they need to be evaluated in the specific contexts in which they were calculated. Thus, it is important that the values summarised above are not simply applied uncritically to the South African situation, but that local circumstances be taken into account as far as possible. Finally, it is important that assumptions, methodologies and limitations are made explicit in order that the results of the valuation exercise can be appraised in the appropriate context.

### **Externalities in South Africa's fuel cycle**

Given time and information constraints, it was not possible in this study to evaluate externalities at every step in the chain; moreover, beyond a certain point, there are diminishing returns from widening the scope of the study to include less serious environmental and other impacts.

A degree of judgement is required in making decisions regarding which externalities are potentially significant and which are not. Consequently, a classification system has been used, which makes explicit the criteria used in determining the scope of the quantification exercise. Environmental impacts were classified according to the following three categories:

- *Class One impacts.* These are environmental impacts which are potentially serious, and for which sufficient information exists to permit an estimate of their economic value.
- *Class Two impacts.* These are impacts which are potentially serious, but for which there is insufficient data to permit an economic assessment of external costs within an acceptable range of certainty.
- *Class Three impacts.* These are impacts which, on balance of evidence and probability, are not likely to be highly material in relation to other impacts and, therefore, no attempt is made to quantify them in economic terms; alternatively, the environmental costs of these impacts have already been substantially internalised.

Environmental impacts arise at most stages in the fuel cycles. These impacts are subject to varying levels of management and attempts to ameliorate them; in other words, some of these impacts are already fully or partially internalised into the pricing structure of electricity. In considering the coal and nuclear fuel cycles, 10 potentially important impacts have been considered, of which five have been categorised as Class One impacts for present purposes. These are summarised in Table 5.

Numerous other impacts arise from coal-fired generation: for example, the health impacts of electromagnetic fields around high-voltage transmission lines, the loss of pro-

ductive land above underground mines due to subsidence and the aesthetic impacts of large power stations and transmission lines in rural areas. While any number of such impacts may have significant environmental or social impacts in their specific or local contexts, they have not been considered in any detail in this study, either because they are not significant in aggregate on a national scale, or because the costs of those impacts have already been substantially internalised.

**TABLE 5** Summary of potentially significant environmental impacts and their classification in this study

	Class One	Class Two	Class Three
<b><i>Coal fuel cycle</i></b>			
Coalmining: morbidity and mortality	✓	✓	
Coalmining: air and water pollution		✓	✓
Generation: water consumption	✓		
Generation: air pollution and health impacts	✓	✓	
Generation: air pollution and acidification		✓	
Generation: air pollution and visibility		✓	
Generation: water quality impacts			✓
Generation: greenhouse gas emissions	✓		
<b><i>Nuclear fuel cycle</i></b>			
Fiscal subsidy to industry	✓		
Environmental impacts (risk of accident, waste disposal, decommissioning costs, etc.)	✓		

Space constraints preclude any discussion of impacts other than those in the Class One category. For information about the state of knowledge regarding Class Two and Class Three impacts, reference can be made to Van Horen (1996a). The sections which follow describe the nature and extent of externalities for the five Class One impacts noted above.

### **Occupational health effects in coalmining**

Workers in coal mines are exposed to a number of risks. These include rockfalls, methane explosions, transport accidents and accidents in the handling of materials, which may result in immediate injury or death. A second category of occupational risks results from prolonged exposure of workers to air pollution resulting from mining activities: although the illnesses which occur are often significant, insufficient data exists regarding their scale and so this has been classified as a Class Two externality.

The Leon Commission of Enquiry reported in mid-1995 on the state of health and safety on South Africa's gold and coalmines. The general tone of the commission's report was sharply critical of the health and safety management in the country's gold and coalmines, and highlighted the high morbidity and mortality rates compared to other major mining countries. This was more especially the case in the gold mines, which generally

operate at much deeper levels than coal mines.<sup>11</sup>

Although there is no publicly available information on the rate of injury and death on coalmines supplying Eskom, this has been estimated with reference to data reported by the Leon Commission. The details of this calculation are described more fully in Van Horen (1996a), but the essence is that accident rates attributable to coalmines supplying Eskom are probably lower than industry averages, because the proportion of coal derived from open-cast mines (which have a lower accident rate than underground mines) is higher for Eskom than for the industry as a whole.

The calculated fatality and injury rates for coal mines serving Eskom's power stations are that an average of 0,30 fatalities and 1,68 injuries occur for every million tonnes of coal mined for purposes of power generation. Based on average coal consumption (from Eskom 1995a:54), this translates into 0,156 fatalities and 0,874 injuries per thousand GWh of electricity produced. If this rate is applied to 1994 electricity production of 149 443 GWh, then a total of 23 workers would have died in coalmines supplying Eskom in that year, and a further 131 would have been injured.

The nature of injuries sustained by coalminers varies widely, from relatively minor injuries to permanently disabling ones. Their costs include the costs of medical treatment and the opportunity costs of not working. These have been estimated based on discussions with the Government Mining Engineer.

Based on the above estimates and using the valuation data described earlier, the valuation estimates are shown in Table 6.

**TABLE 6** Valuation estimates for mortality and morbidity on coal mines, 1994, in total and in c/kWh

	Low estimate	Central estimate	High estimate
Total (R million)	16,8	24,5	34,5
Total in c/kWh	0,01	0,02	0,02

As noted above, an important category of occupational morbidity has not been included in the above valuation estimates, namely, the occurrence of respiratory and other diseases resulting from prolonged exposure of coalminers to high levels of dust and other airborne particulate matter. The effect of this omission will be to underestimate actual externality values.

### Water consumption in power generation

Coal-powered electricity generation accounts for about 3% of total water consumption in South Africa (Roome 1995). Water is an integral part of the thermal power generation proc-

<sup>11</sup> Ironically, the release of the Leon Commission report coincided with a serious accident at the Vaal Reefs Gold Mine, in which 104 miners were killed when their lift-cage dropped hundreds of metres down a mine shaft.

ess, being used not only (as steam) to drive the turbines which generate electricity, but also to cool down the steam in large cooling towers. Most of Eskom's power stations utilise conventional wet-cooling processes, although two—Kendal and Matimba—use dry-cooling processes which were pioneered by Eskom.<sup>12</sup> Average (net) water consumption in 1994 for all of Eskom's coal power stations was 1,43 litres per kWh generated; the two dry-cooled power stations consumed just over 10% of this (Fraser 1995). Although water prices varied widely from one power station to another, the average in 1994 was R0,66 per m<sup>3</sup>.

Water costs represent a small fraction of Eskom's total operating costs: in the region of 1,8% of direct operating costs (excluding depreciation and finance charges) (calculated from Eskom 1995a:41). This, however, understates the importance of water as an input into the electricity generation process—it is an essential raw material, underlined by the fact that Eskom was directly involved in the construction or financing of several dams, long before other water consumers demanded water in those areas.

As in the case of coal, Eskom has benefited from water prices which have been low and stable over time. There is a wide range of pricing contracts in place with respect to Eskom's water purchases, each dependent upon the specific source of supply. In general, Eskom purchases its water from the Department of Water Affairs and Forestry and pays on the basis of the historic costs of supplying that water, as distinct from the marginal cost of supplying water. Since the cost of supplying water is dependent primarily on the capital costs of constructing the necessary infrastructure, the use of historic costs for water pricing leads to low prices, especially where the capital infrastructure was constructed some time ago. Lethabo power station, for instance, draws its water from the Vaal River which, was dammed in the early 1900s, hence its water price (R0,12 per m<sup>3</sup> in 1994) was very low.

A review of the national pricing policy for bulk water supply was commenced in 1995, with a view to developing a policy which provides adequate signals to water consumers regarding the economic cost of water (Department of Water Affairs and Forestry 1995). By the end of 1995, no firm estimates had been made regarding marginal costing scenarios for water supply, although several values have been presented. One benchmark which is informing the policy debate is the cost of supplying water to the Highveld from the Lesotho Highlands Water Scheme. Again, some uncertainty exists regarding the economic cost of that water, especially because the feasibility studies are several years old; however, a value of R1,50 per m<sup>3</sup> has commonly been quoted (Roome 1995). Some estimates of the economic cost of supplying additional water on the Highveld are higher, at about R3,00 per m<sup>3</sup>, although there has been little analysis to underpin those estimates (*ibid*).

For purposes of this study, the central estimate of the economic value of water supplies to the power stations is R1,50 per m<sup>3</sup>, with low and high values of R1,20 and R1,80 respectively. The external costs implicit in these water prices, expressed in terms total rand and c/kWh of electricity generated, are shown in Table 7.

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<sup>12</sup> In these power stations, the cooling towers utilise massive fans to blow air onto hot water pipes to cool them down.

**TABLE 7** Valuation estimates for water consumption external effects

	Low estimate	Central estimate	High estimate
Total value (Rmillion)	120,8	185,8	250,7
Average (c/kWh)	0,08	0,13	0,17

### Air pollution from power generation: health impacts

The evaluation of the health impacts from power station emissions is one of the more complex but important externalities to be considered. Quantification of health impacts requires information for four steps in the impact pathway:

- the quantities of pollution emitted by power stations;
- the dispersion and ultimate deposition of those pollutants;
- the responsiveness of human health to various exposures (doses) of pollution; and
- the valuation of increased morbidity and mortality.

Space limitations do not allow for data for each of these steps to be described in full here (refer to Van Horen 1996a for details); instead, only pertinent considerations are outlined.

For purpose of quantifying externalities in this study, a computer modelling tool called EXMOD was used. EXMOD follows the damage function approach as outlined above. Data regarding each of the above four categories was collected and used to model the actual damages from air pollution emissions. EXMOD was developed over the period 1993 to early-1995 for the New York State environmental externalities cost study, with support from the Empire State Electric Energy Research Corporation, the New York State Energy Research and Development Authority, the New York Department of Public Service and the Electric Power Research Institute. The aim of that study was to develop a user-friendly damage function tool with which impacts of new or relicensed electricity supply and demand management options could be evaluated. The work in the New York study was summarised in four comprehensive volumes (Rowe et al 1993, 1994, Bernow et al 1995a, 1995b),<sup>13</sup> as well as a shorter paper (Rowe et al 1995). Following a review of international externalities studies, and particularly of models which could be of potential use in the South African context, EXMOD was investigated and selected for use in this study.

With regard to the quantity of pollution emitted, data on actual emissions for 1994 was used for this study. It is worth noting briefly that the coal used in South Africa's power stations is generally of poor quality, since the highest grade coals are exported. The average sulphur content of coals used by Eskom is relatively low at around 1%, whereas ash content is high, ranging from 21% at Arnot power station to 39% at Lethabo. The latter also has the lowest calorific value (energy content), at 15,2 megajoules per kilogram of coal. It is significant to note that with such a low energy content, "coal" could not be used in any conventional commer-

<sup>13</sup> All of these reports will be published in a two volume book by Oceana Press, New York State in 1996.

cial or domestic process.<sup>14</sup> Thus, electricity is being generated from a product which would otherwise have little or no economic value.

The negative side of this is that, all other things being equal, particulate emissions and ash production are relatively high. As a consequence, Eskom's pollution control policy is focused mainly on the reduction of particulate emissions. All of its operational coal power stations utilise electrostatic precipitators, which operate with an efficiency of around 90 to 99,7% (Tilley and Keir 1994), although it should be noted that it is the finest particles (that is, with the smallest diameter) which present the greatest potential health hazard, since it is these which are small enough to be respirable.<sup>15</sup> In addition to electrostatic precipitators, Eskom has installed bag filters on a trial basis at some of its power stations. Where these are used successfully in combination with electrostatic precipitators, efficiencies of 99,99% are possible (Hanson 1992).

Furthermore, Eskom's newer power stations have tall chimney stacks so that emissions penetrate the inversion layer and are released into the upper atmosphere. This inversion layer is an important feature of atmospheric conditions in the Mpumalanga Highveld because it inhibits the dispersal of ground-level or low-level emissions, especially during winter months (Tyson et al 1988). All of Eskom's power stations have relatively tall chimney stacks of 200 metres or more, except Arnot (193 metres) and Hendrina (110 metres).

A final point to note in relation to Eskom's air pollution policy is that it has decided that desulphurisation and denitrification technologies are not warranted. Therefore, no active measures are taken to reduce the emissions of sulphur dioxide or nitrogen oxides. This is an issue which has received much attention in recent years, although there has been no systematic investigation of the costs and benefits of respective pollution control options.

Total emissions from the nine operational coal power stations in 1994 were as follows: total suspended particulates, 122,42 kilotonnes (equivalent to 0,84 kg/MWh); for sulphur dioxide, 1 166,7 kilotonnes (7,88 kg/MWh); and for nitrogen oxides, 960,9 kilotonnes (6,49 kg/MWh) (Eskom Generation Group 1995).

It is important to note that this data excludes pollution originating from the ash dumps at power stations. Although Eskom has an extensive programme of ash management, it produces an enormous quantity of ash: some 22 million tonnes in 1994, of which about 3% was reused for cement or brick-making (Eskom 1995b:23). This translates into a continuous production rate of 42 tonnes of ash per minute.

The second step in the damage function approach concerns what happens to those pollutants after they are emitted, that is, how they are dispersed in the atmosphere and where they are deposited. For this to be assessed, information was assembled regarding physical emission characteristics, such as the height of chimney stacks and the speed, volume and temperature of flue gas emissions, as well as atmospheric conditions, including wind patterns (derived from long-term data), mixing heights and atmospheric stability.

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<sup>14</sup> Indeed, this coal cannot even be ignited with a blowtorch!

<sup>15</sup> Particulate matter with a diameter of 10 mm (microns) or less is usually regarded as being in the respirable range (hence the label PM10).

A reasonably significant amount of air quality research has been undertaken by Eskom in the Mpumalanga Highveld since the mid-1980s. This cannot be reviewed in detail here (refer to Van Horen 1996a for this), save to mention that the air quality data collected suggests that the pollutants which exceed or approach health guidelines most frequently are ozone and sulphur dioxide. Of less concern are concentrations of particulates and nitrogen oxides, which are reported to be well within government guidelines.

Dose-response relationships constitute the third step in the impact pathway, namely, the link between ambient pollution exposures and health outcomes: in this case, respiratory illnesses. The human health effects of pollution exposures have been widely studied in a number of countries in response to a range of environmental conditions. In South Africa, there have been relatively few studies of the health effects of air pollution, and although a handful of studies have attempted to find correlations between environmental quality—mainly particulate concentrations—and health outcomes—mainly respiratory illnesses (see, for example, Terblanche et al 1992, 1993)—there have been no studies which have quantified the dose-response function for pollution exposures.<sup>16</sup>

Reference has, therefore, been made to the international literature to identify dose-response functions which might be applicable to South Africa. For purposes of the project in New York State, USA, which developed the EXMOD model, extensive reviews were undertaken of epidemiological and bio-medical literature in order to derive dose-response functions which could be used with a satisfactory degree of certainty (Rowe et al 1994: chapter V). A strict set of criteria were applied in the selection of epidemiological studies for that purpose.<sup>17</sup> On the basis of a large number of studies which followed similar methodologies and were reasonably comparable, dose-response functions were derived for a range of air pollutants.

Again, space constraints do not allow for these relationships to be described in full here, but to illustrate the nature of these relationships it has been estimated from epidemiological studies that one in 3.3 million people will die for every 1mg per m<sup>3</sup> increase in ozone concentrations. Put differently, if 40 million South Africans are exposed to an additional 1mg per m<sup>3</sup> of ozone pollution, the central estimate implied by this risk factor is that 12 people will die prematurely each year. Dose-response functions were used for several health outcomes, such as asthma attacks, acute and chronic bronchitis, visits to doctors and hospitals for respiratory symptoms, mortality, hospital admissions for respiratory ailments and days away from work due to illness. In addition, for each dose-response function, low, central and high values have been used to reflect uncertainty.

There is an unavoidable measure of uncertainty in applying dose-response relationship data which was derived in North America to South Africa. Clearly, environmental and health characteristics differ in these two environments. At the most basic level, human physiology and responses to environmental conditions do not differ according to national bounda-

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<sup>16</sup> See Van Horen (1994) or Lerer (1995) for a review and analysis of South African and international studies at the energy-health interface.

<sup>17</sup> These are described in detail in Rowe et al (1994: V-3 to V-4).

ries. A factor such as lower nutritional status, for instance, means that South Africans may have lower resistance to environmental hazards and, therefore, be more susceptible to illness (Terblanche 1995). The bias which this factor introduces means that the selected dose-response relationships would tend to underestimate the actual health outcomes in South Africa. Other factors would also affect these functions, and so the overall direction of bias is not clear.

Another, more technical, uncertainty concerns assumptions about threshold levels of pollution. Although environmental standards are traditionally based on an assumption that there is a level of pollution below which health effects can be safely assumed not to exist, recent epidemiological evidence suggests that such thresholds do not exist. Consequently, this study has used a zero threshold level.<sup>18</sup>

The valuation of health effects resulting from air pollution exposures is the final step in the impact pathway analysis. Valuation was undertaken using the EXMOD modelling tool, with data on the following items:

- Eskom's nine coal power stations, including their fuel types and composition;
- demographic data for each magisterial district in South Africa from 1991 census data, including total population, age distribution, land area, geographical coordinates and the average altitude of the district;
- aggregated demographic data for the following neighbouring countries: Lesotho, Swaziland, Mozambique, Zimbabwe, Botswana and Namibia;
- long-term (10 to 20-year average) surface wind data for 15 monitoring stations in South Africa (and two in Namibia);
- emissions data for each of Eskom's nine operational power stations for the main air pollutants: particulates, sulphur dioxide and nitrogen oxides;
- dose-response data for the health outcomes described earlier; and
- valuation data for health outcomes, based on opportunity costs of health effects.

The EXMOD model incorporates three air dispersion models, covering short-range, medium-range and long-range transport of pollutants.<sup>19</sup> Consequently, the model was run nine times, corresponding to data sets for each of the nine operational coal power stations, and using the above data categories.

The results of the model computations include both the physical health outcomes (number of cases of asthma attack, chronic bronchitis, and so on) and the economic costs of those effects. The incidence of certain of these health outcomes is relatively high: notably, asthma attacks, respiratory symptom days and days of restricted activity. Also significant is the number of mortalities which are expected to occur each year: 174 in the central estimate (EXMOD computations). This is not insignificant, even in relation to the high population on the Highveld within a few hundred kilometres of the power stations.

<sup>18</sup> See Van Horen (1996a) for a more detailed discussion of this assumption.

<sup>19</sup> There is inherent uncertainty in using these dispersion models on the Highveld because of its particular atmospheric conditions, which differ from those elsewhere. However, there are no other models available specific to Highveld conditions.

The results of applying opportunity cost valuation data to the physical health outcomes are shown in Table 8. This table shows the range of estimates, in cents per kWh, of morbidity and mortality resulting from emissions of sulphur dioxide, nitrogen oxides and particulate matter.

The valuation results for the nine coal power stations are of a similar order of magnitude: the lowest damages arise from Matimba power station with a central estimate of 0,23 c/kWh, due to the fact that it is located in a less-densely populated area in Northern Province; the highest damages arise from Kriel and Hendrina, probably because their nitrogen oxide and particulate emission factors, respectively, were relatively high (based on 1994 emissions).<sup>20</sup> Based on actual electricity generated during 1994, the weighted average cost of damages from air pollution was calculated as 0,54 c/kWh for the central estimate, with a low of 0,39 c/kWh and a high of 0,67 c/kWh. It should be noted, once again, that this excludes the Class Two damages which have not been quantified, such as damages resulting from acidic deposition or impaired visibility. Thus, there is certainty over the direction of at least one source of bias in these estimates, namely, that the estimates will underestimate some external effects.

**TABLE 8** Valuation of morbidity and mortality from power station emissions in c/kWh, 1994 (EXMOD computations)

	Low estimate (c/kWh)	Central estimate (c/kWh)	High estimate (c/kWh)
Arnot	0,36	0,45	0,53
Duvha	0,37	0,53	0,66
Hendrina	0,57	0,72	0,86
Kendal	0,46	0,63	0,78
Kriel	0,52	0,75	0,95
Lethabo	0,48	0,65	0,80
Matimba	0,18	0,23	0,27
Matla	0,41	0,59	0,74
Tutuka	0,32	0,46	0,57
Weighted average	0,39	0,54	0,67

<sup>20</sup> Nitrogen oxide emissions impact upon human health more particularly through the formation of ozone.

## Greenhouse gas emissions from power generation

Electricity generation, where it is based on coal power, is unavoidably a significant source of greenhouse gas emissions.<sup>21</sup> The principal greenhouse gas emissions are carbon dioxide ( $\text{CO}_2$ ), methane, chlorofluorocarbons and nitrous oxides, the first two of which are most significant in South Africa. South Africa was responsible for about 1.2% of global greenhouse gas emissions in 1988, making it the 18th largest source in the world, and one of the largest sources on a per capita basis (Van Horen and Simmonds 1995). It was also the largest source of greenhouse gases in Africa, accounting for 15% of the continent's  $\text{CO}_2$  emissions.

Significant quantities of carbon dioxide are emitted by the electricity generation industry, and smaller amounts of methane during coalmining. Eskom is the single largest source of greenhouse gases in South Africa which, by its calculations, amounted to some 142,9 million tonnes of carbon dioxide in 1994 (Eskom 1995b).<sup>22</sup>

There is a vast body of international literature which has sprung up around the climate change phenomenon, addressing both its physical and political-economic dimensions. It is impossible to summarise all aspects of this issue here. For present purposes, it is important to note that there is considerable uncertainty around climate change in various of its dimensions. One of the key uncertainties is around the potential impacts of climate change on specific subregions, such as southern Africa. This uncertainty, exacerbated by the extremely long time periods over which it might occur,<sup>23</sup> makes it extremely difficult to make assessments of the economic and social costs of possible climate change. These may include, for example, the costs of possible increased drought in the future, and more frequent occurrences of extreme weather events (storms, floods and droughts). Several attempts have been made internationally to estimate the range of damage costs which might result from climate change (for example, Cline 1992, Fankhauser 1992, Nordhaus 1993): not surprisingly, these have produced very different estimates and have attracted their share of criticism. This uncertainty presents special difficulties for the present study.

What is certain, however, is that the climate change issue will not disappear from the international political economy in the near future. Given the prominent role of South Africa among developing countries, it is essential that the issue is not ignored.

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<sup>21</sup> Briefly, greenhouse gases are relevant in so far as they are widely believed to enhance the naturally occurring greenhouse effect—in terms of which greenhouse gases increase the ability of the earth's atmosphere to retain warmth. The balance of scientific opinion suggests that continued emission of greenhouse gases at present rates will lead to global climate change with variable, but often negative, consequences in many regions of the world. For more details on recent developments in the international climate change debate, see Rowlands (1995a), and on the South African energy sector's contribution, see Van Horen and Simmonds (1995).

<sup>22</sup> The power sector is also indirectly responsible for the emission of methane from coal mines; however, these are not included in the present analysis for lack of data.

<sup>23</sup> With concomitant importance attached to the selection of a discount rate when economic effects are being considered.

One of the most recent economic studies of climate change damages has been done by working group III of the Intergovernmental Panel on Climate Change (IPCC), the body of leading social and natural scientists informing the international negotiation process. The analysis undertaken by this group has suggested that the annual costs of global warming will be in the region of 1,5% to 2% of gross world product by the time CO<sub>2</sub> concentrations reach double their natural levels—somewhere around 2050 or 2060 on the basis of current trends.<sup>24</sup>

By relating global damage costs to current emissions of greenhouse gases, it is possible to estimate a cost per tonne of greenhouse gas or, more particularly, CO<sub>2</sub> emissions. Corresponding with the high level of uncertainty over future damage costs, there is an equally wide range of “per ton” damage cost scenarios. The IPCC, in its 1995 second assessment report, “does not endorse any particular range of values for the marginal damage of CO<sub>2</sub> emissions”, but instead referred to published estimates which fall in the range of \$5 to \$125 per tonne (IPCC 1995). One such estimate, by Fankhauser and Pearce (1993), both of whom were centrally involved in this aspect of the IPCC working group III’s work, amounted to 14 pound per tonne of CO<sub>2</sub>, equivalent to R80 or \$22 per tonne (reported in Pearce 1995: 31).<sup>25</sup> This value was used as the central estimate in this study. For the low estimate, the lowest value referred to in the IPCC report will be used: \$5 per tonne, equivalent to R18 per tonne. The choice of a high value is made more complicated by the wide range of estimates which have been published. For present purposes, the high estimate of damages has been taken as being 50% higher than the central estimate, that is, R120 per tonne (or nearly \$33 per tonne). On this basis, the estimates of damages from South African power station emissions of greenhouse gases are shown in Table 9.

**TABLE 9** Valuation estimates for CO<sub>2</sub>-induced climate change damages

	Low estimate (Rmillion)	Central estimate (Rmillion)	High estimate (Rmillion)
Total value (Rmillion)	2 572,2	11 432,0	17 148,0
Average c/kWh	1,74	7,72	11,59

### Fiscal externalities in the nuclear industry

A final category of externalities which arises in the South African electricity generation industry are those subsidies which have flowed to the nuclear industry from public funds. This may be termed a “fiscal externality”—a fiscal transfer payment (for example, a sub-

<sup>24</sup> Notably, this analysis has been criticised by some economists as being far too conservative, with alternative estimates of global costs being in the range of 12% to 130% of gross world product by the year 2050 (Meyer and Cooper 1995).

<sup>25</sup> An exchange rate of R5,68 to the UK pound is used.

sidy) which is made to the nuclear industry and which is not reflected in the price of nuclear electricity (Lockwood 1992). While this is not an environmental externality *per se*, it is a potentially material externality in South Africa which could be significant in relation to the price of electricity, and so it is included in the scope of this study.

Unlike the coal-fired electricity sector, which has historically received little or no financial subsidy from public funds, the local nuclear industry has enjoyed a very privileged position in this respect. This is similar to the nuclear industry in the UK and elsewhere (Lockwood 1992).

The nuclear industry has received an average of 69,3% of the Department of Mineral and Energy Affairs annual parliamentary grant over the period 1971-72 to 1995-96 (calculated from Auf der Heyde 1993). The total allocation over this period was R8 528 million in nominal terms; when these amounts are adjusted to real 1995 rand by the producer price index (from Central Statistical Service 1995), the total allocation amounts to some R21 753 million.

Thus, considerable resources have been directed to the local nuclear industry. These have been directed to three main categories of expenditure: capital expenditure, operating expenditure and servicing and repayment of loans (*ibid*:7). Not all of these amounts should be attributed to the nuclear generation industry, since non-electricity aspects of the industry have also benefited from state subsidies: notably the nuclear bomb programme, research and development in non-electric areas, and the production of medical isotopes. Unfortunately there is no publicly available information on the allocation of the subsidy to these various sectors; consequently, calculations and assumptions have been made on the basis of available information. To be conservative, only those costs which are known to be related to electricity generation have been included in the analysis; thus these represent a minimum estimate of the fiscal subsidy to the industry and probably underestimate actual costs. The details of this calculation are provided in Van Horen (1996a). The estimated portion of the total allocation which can be attributed to the electricity industry is R12 298 million (in 1995 rand) for the period 1971-72 to 1995-96, or 57% of the total grant.

In order to calculate an average external cost, three scenarios have been used for purposes of spreading the fiscal subsidy over the lifetime of the assets to which it relates:

- low estimate: the subsidy ceases from 1996-97 onwards and the power station operates at current capacity until 2023;
- central estimate: the subsidy is phased out from its current level to zero by the year 2000,<sup>26</sup> while operations remain at their current level; and
- high estimate: support for the industry terminates and production of electricity ceases at the end of 1996.

Table 10 summarises the external costs for each of these three scenarios. Electricity generation figures are based on actual production since the power station was commissioned, and assumed output for the remainder of its 40-year life at 1995 levels.

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<sup>26</sup> Thus, the allocation to the electricity component of the industry is assumed to be 57% of the annual allocations: R489,2 million for 1996-97, R366,9 million for 1997-98, R244,6 million for 1998-99, and R122,3 million in 1999-2000 (all in 1995 rand).

**TABLE 10** Valuation of fiscal externalities in the nuclear industry

	Low estimate	Central estimate	High estimate
Total subsidy (Rmillion 1995)	R12 298	R12 995	R12 298
Cumulative generation (GWh)	370 848	370 848	109 029
External cost, c/kWh	3,32	3,50	11,28

It should also be noted that the central scenario is consistent with the Atomic Energy Corporation's so-called "2000 plus" business plan. However, the trend in the 1995-96 and 1996-97 budget allocations does not appear to be in line with this plan; in fact, the subsidy has not been reduced by as much as envisaged, which means the central estimate may underestimate the amount of the fiscal externality.

### Summary of results and limitations

The values for the five Class One externalities are summarised in Table 11. It should be noted that the valuations in the table are not additive, since they do not have a common base: they are expressed in relation to the amount of coal and nuclear electricity generated, respectively.

**TABLE 11** Summary of valuation results for Class One externalities in c/kWh, 1994

	Level of uncertainty	Low estimate	Central estimate	High estimate
Coalmining: injuries and mortalities <sup>1</sup>	Moderate	0,01	0,02	0,02
Generation: water consumption	Moderate	0,08	0,13	0,17
Generation: air pollution and health impacts <sup>2</sup>	moderate	0,39	0,54	0,67
Generation: greenhouse gases	Moderate	1,74	7,72	11,59
Nuclear: fiscal subsidy	Moderate	3,32	3,50	11,28

#### Notes

<sup>1</sup> The external costs of coalminers' morbidity (chronic and acute illness) have not been quantified because insufficient information exists regarding their pollution exposures.

<sup>2</sup> The external costs of health impacts caused by pollution originating from ash dumps on the power stations have not been quantified because insufficient information exists regarding the quantity of emissions and their dispersal.

Summarising the Class One externalities in Table 11, totals can be derived for the coal and nuclear cycles, and for an average of both. These results are shown in Table 12. The weighted average external cost takes into account the relative proportions of coal and nuclear electricity generated by Eskom.

**TABLE 12** Summary of externality valuations for coal and nuclear cycles in c/kWh, 1994

	Low estimate	Central estimate	High estimate
Total coal fuel cycle	2.23	8.41	12.45
Nuclear: fiscal subsidy	3.32	3.50	11.28
Weighted average external cost	2.29	8.11	12.34

The central estimate for all Class One externalities included in this study is, therefore, 8,11 c/kWh, with a lower bound of 2,29 c/kWh and an upper estimate of 12,34 c/kWh. It is evident from the above tables that the external costs of the nuclear cycle are high on a per unit basis. Taking only the externalities in the coal fuel cycle, the resultant cost is 8,41 c/kWh for the central estimate, 2,23 c/kWh for the low estimate and 12,45 c/kWh for the high estimate. Furthermore, if damages attributable to greenhouse gas emissions are removed altogether, and fiscal externalities in the nuclear cycle are also ignored, the central estimate is 0,69 c/kWh, with low and high ranges of 0,49 c/kWh and 0,86 c/kWh respectively.

These results can be placed into context by comparing them with current electricity price levels. The relative significance of the externalities obviously varies depending on the choice of a benchmark tariff; for present purposes, Eskom's weighted average tariff for all consumers is used. Table 13 makes this comparison, with a breakdown for each of the five Class One externalities.

**TABLE 13** Average Class One externalities as a percent of Eskom's average tariffs, 1994

	Low estimate	Central estimate	High estimate
Coalmining: injuries and mortalities	0,1%	0,1%	0,2%
Generation: water consumption	0,7%	1,0%	1,3%
Generation: air pollution and health impacts	3,1%	4,3%	5,3%
Generation: greenhouse gases	13,9%	61,6%	92,5%
Nuclear: fiscal subsidy	1,7%	1,8%	5,9%
Total	19,5%	68,9%	105,3%

Because nuclear electricity accounted for just over 6% of the coal-nuclear total, its relative impact on electricity prices becomes much smaller than when compared to nuclear-generated electricity alone. Much more significant in this comparison is the impact of assumed damage costs from climate change where these are anything other than negligible on a per tonne basis. Of the environmental externalities experienced within the country and its neighbours in the relatively short-term, health impacts of air emissions are most significant, representing between 3% and 5% of current electricity prices.

It is worth making a brief comparison of the results of this analysis with the results of externality studies undertaken elsewhere—as summarised in Table 3. The valuations in this study fall somewhere between the two main sets of externality values derived internationally—perhaps closer to the lower, more recent bottom-up studies in the second half of Table 3. This is consistent with expectations: on the one hand, it would be expected that the external costs in South Africa might be higher than those in Europe or North America where emissions standards and environmental controls are generally much stricter; on the other hand, this study excluded many externalities for which there was insufficient data, which would be expected to result in lower valuation results here. In conclusion, the results of the present study, albeit subject to a number of limitations which are outlined below, appear plausible on the basis of international experience.

### **Limitations and weaknesses of the study**

It is important in a quantitative analysis such as this to stress that the calculated figures are as good only as the input assumptions and information from which they are derived. By its nature, any externalities study is subject to a number of limitations and weaknesses, which means that the economic values should not be taken simply at face value. Rather, they should be analysed in full awareness of the limitations of the study, of which there are three main categories: omissions, uncertainties and biases.

Firstly, in the case of *omissions*, Class Two and Class Three impacts were not quantified in the present study. Class Two impacts included the following:

- chronic and acute illnesses experienced by workers on coalmines supplying Eskom;
- impacts of air and water pollution emitted by coalmines supplying the power stations;
- impacts on human health of air pollution originating from coal power stations' ash dumps;
- impacts of coal power station emissions and resultant acidic deposition, in terms of human health, damages to crops, forests, water supplies and other physical assets in the Mpumalanga Highveld and neighbouring regions;
- impacts of coal power station emissions on visibility conditions, particularly in the Mpumalanga Highveld;
- impacts of coal power station emissions into watercourses; and
- impacts of nuclear power stations on environmental quality and human health.

It is possible that the economic value of some of these externalities will be significant and they, therefore, warrant further investigation. In addition to these issues, it is possible that some of the externalities which were accorded a Class Three rating in this study could have significant economic values. Ideally, all of these effects should be subjected to a more comprehensive analysis.

With respect to *uncertainties* in the present analysis, Table 11 summarised the level of uncertainty for each of the Class One impacts, at a very broad level. The most significant areas of uncertainty include the following:

- in the case of injuries and deaths occurring in the coalmining sector, data for the coalmining industry as a whole had to be apportioned between the main consumers, since data was not available specifically for the coalmines supplying Eskom.

The effect of this may have been either to understate or overstate the results;

- there is uncertainty over the applicability of dose-response functions derived in North America to South African populations. No epidemiological studies have yet derived these relationships for South Africa;
- with regard to the valuation of health impacts of air pollution, there is a moderate level of uncertainty regarding the atmospheric modelling approach used. The EXMOD model used a Gaussian plume type of dispersion model to approximate the dispersion of emissions from power station chimneys, whereas actual conditions on the Highveld are not especially well-represented by this kind of model (Turner 1995). In the absence of any atmospheric model designed specifically for South African conditions, however, this level of uncertainty is unavoidable;
- there is a high level of uncertainty regarding the future global impacts of anthropogenic greenhouse gas emissions in the economic, social and environmental spheres; and
- there has been very little previous analysis of the economic value of environmental and health issues, from the pricing of water to the value of human health and mortality and, consequently, there is a high level of uncertainty in this respect.

These uncertainties have been accommodated, to an extent, by utilising a *range* of estimates rather than a single one so as to reflect the inherent uncertainty. In most of the cases above, there would be benefits to undertaking further investigation to narrow the range of uncertainty.

It is important to be explicit about the effect of these omissions and uncertainties on the economic valuations which have been reported in this study, that is, whether the direction of the resultant *bias* will be to understate or overstate the externality valuations. A summary of these potential biases is shown in Table 14.

**TABLE 14** Summary of potential biases in this study due to omissions and uncertainties

Uncertainty or omission	Direction of bias on externality values		
	Understated	Unknown	Overstated
Class Two and Class Three impacts omitted (refer above)	x	?	
Coalmine accident rates: industry average versus Eskom suppliers rates		?	
Dose-response functions: North American versus South African data	x	?	
Atmospheric dispersion modelling		?	
Future impacts of greenhouse gas emissions		?	
Valuation of environmental and health impacts		?	

The overall effect of these biases is difficult to assess since any one of them (for example, greenhouse gas impacts) could be large enough to more than offset all others. Nonetheless, it is important to note that there is one definite source of bias, namely, the omission of Class Two and Class Three impacts, which would cause estimates to underestimate actual impacts. In all cases in this study the chosen route has been to err on the side of understating external effects rather than the opposite. Thus, there is a fairly high level of confidence that the range of quantified externalities does not overstate the *minimum* value of externalities in the South African power sector.

### **Implications for South Africa's development policy**

In effect, the analysis in this chapter represents a first (and by no means a conclusive) attempt to value the external costs of electricity generation. This is useful for several purposes. Firstly, it represents a baseline against which comparisons can be made in future. If, for instance, environmental policies are introduced with a view to reducing air pollution concentrations, progress can be evaluated in the future in economic terms by comparing them with the 1994 baseline described here.

Secondly, the valuation of external costs is a necessary component of any cost-benefit analyses of abatement options which may be considered. Thus, for instance, an assessment of the relative costs and benefits of utilising technologies with lower sulphur emissions (such as scrubbers or fluidised bed combustion), should include, on the one hand, the costs of those technologies and, on the other hand, the benefits which they will bring about. Their environmental benefits will, simplistically, be equal to the avoided external costs. To the extent that this study estimated the value of these externalities, it provides one of the basic building blocks for such a cost-benefit analysis.

Thirdly, quantification of external costs is an essential component of integrated resource planning. Integrated resource planning is a planning approach in which all energy supply and demand options are evaluated with a view to making the resource choice which is optimal from the view of society as a whole.<sup>27</sup> Typically, integrated resource planning assessments compare energy supply investments (such as building another coal power station, or importing hydroelectricity) with demand-side management options and seek to make the comparison on an equal footing. Since the private costs and external costs of these options vary widely, it is important to include all costs in such comparisons. Therefore, when Eskom makes its next decision about how to satisfy the country's electricity needs, it should do this on the basis of full cost comparisons, using a comparable methodology to that in this study.

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<sup>27</sup> Integrated resource planning is widely used in North America, where electricity regulators stipulate that utilities have to undertake an integrated resource planning assessment of all the options they face for meeting demand. These assessments typically include quantification of external costs.

<sup>28</sup> The philosophy of China and certain newly industrialised countries in South-East Asia is sometimes characterised in this way.

Eskom's vision is to "provide the world's lowest-cost electricity for growth and prosperity" (Eskom 1995: i). The results of this study suggest that this vision, by itself, might not best serve the country's interests. To illustrate, it would be quite possible for South Africa to be the world's cheapest electricity producer if it paid no regard whatsoever to environmental conditions and polluted the environment freely.<sup>28</sup> In essence, such a situation would amount to a subsidy being granted to the industry by the environment—in both its natural and social dimensions. This kind of subsidy is just as unsustainable as the large fiscal subsidies which many utilities in Latin America and Africa received from their governments, notably during the 1970s and 1980s.

It is obvious that Eskom does not act in single-minded pursuit of low-cost electricity, without regard for the environmental consequences of its actions. It has invested in technologies to reduce its impact on its surroundings (for example, electrostatic precipitators), and it incurs ongoing expenditure on the management of its impacts. It reported in its first environmental report that approximately R135 million had been spent on environmental management and research during 1994 (Eskom 1995b: 35). Over half of this was on air quality management in the generation division (Roos 1995).

The relevant question, therefore, relates to the *degree* to which environmental considerations are taken on board in the pursuit of cheap electricity. Clearly, there are external costs associated with producing electricity, and "artificially" low prices provide a powerful but dangerous signal to electricity consumers. It is not difficult to imagine a scenario in which major electricity-intensive industries establish themselves in South Africa on the basis of low electricity prices (all other things being equal), but that some years down the line the environmental costs become too large to ignore. At that point, the clean-up costs and control costs could be significant and would probably translate into an unavoidable price shock. Thus, Eskom's original vision—to be the lowest-cost producer in the world—would be severely compromised, with potentially adverse economic effects. It is important, therefore, that Eskom's vision be tempered by its stewardship responsibilities to the natural and social environments.

This study has focused almost exclusively on the supply-side—in other words, on the generation of electricity. While this focus has been deliberate, it is important to flag the demand-side of the industry and, in particular, the possible benefits from implementing energy efficiency and demand-side management policies. Clearly, policy responses aimed at internalising or managing externalities will bring about upward pressure on electricity prices. If, however, energy efficiency interventions are adopted at the same time, the potential exists to offset any such price increases and, indeed, sustain current downward trends.

Internationally, electricity utilities have invested in energy efficiency and demand-side management programmes over the past decade or more, partly in response to public and regulatory pressures to reduce the environmental costs of generating electricity from coal and other fossil fuels. In South Africa, there has been relatively little attention paid to the demand side of the equation, partly as a result of the overcapacity situation in Eskom's coal power stations. Eskom has recently established a residential demand-side management programme, although it remains a relatively low investment priority for the organisation. Nonetheless, indications are that considerable energy savings can be achieved, at low or nega-

tive cost, through the adoption of well-proven technologies and practices. For example, considerable savings can be made in the household sector by improving the thermal performance of low-cost houses which are being connected to the electricity grid. While this is not the place to discuss the large number of energy efficiency and demand-side management options which can be readily implemented, it is important that policy interventions dealing with externalities are part of an integrated approach which balances cost pressures on the supply-side with potential gains on the demand-side.

### **Policy implications related to specific external effects**

This chapter has included quantification of five external effects, and policy responses related to each are outlined briefly below.

- ***Injuries and mortalities in the coalmines***

The safety performance of South African mines in general, including coalmines, was heavily criticised by the Leon Commission. It was the commission's view that the number of injuries and fatalities was "unacceptably high" (1995: 16).

It is not necessary to repeat here the range of recommendations made by the Leon Commission, nor to describe actions taken recently by government. The relevant point for present purposes is to note that more attention to worker health and safety in the coalmines, whether this is driven by stricter regulations, union demands or management initiatives, should have the effect of reducing accident rates. To the extent that this results in incremental costs being incurred by the industry, it is likely that these will be passed on to consumers, meaning ultimately that there would be upward pressure on coal and electricity prices. In economic terms, this is entirely correct: consumers should be aware of, and should pay for, the full implications of their consumption behaviour.

- ***The pricing of water consumed in power stations***

The country's bulk water pricing policy is currently under review (Department of Water Affairs and Forestry 1995), and it is not the intention of this study to pre-empt the results of that process. Nonetheless, it is incontrovertible that the historical cost of supplying water to the power stations bears little relation to the current economic value of that water. As such, Eskom is not being given the correct price signals regarding its consumption patterns and, as a result, its technology choices do not necessarily take account of water scarcity. Only two of its coal power stations, Kendal and Matimba, employ dry cooling technologies.

The appropriate policy is for bulk water supply authorities—generally the Department of Water Affairs and Forestry—to move away from historic cost pricing towards economic pricing of water. This applies both to new supply facilities and to ongoing water consumption in existing power stations. With respect to the former, marginal cost pricing should be implicit in the planning and feasibility studies for any new power stations which are under consideration. In the case of existing facilities, a phased introduction of economic prices should be agreed upon in advance, so that unexpected price effects can be minimised as far as possible. The increase of estimated economic water prices over current prices amounts to about 127% in the central estimate: the doubling of

water prices would have a noticeable effect on electricity prices, and so it is important that new pricing policies are introduced in a well-planned and phased manner. It is important to note, however, that the main objective, ultimately, is for prices to be set at a sufficiently high level to reflect the scarcity of water, and so there is a limit to the concessions which can or should be made for water consumers. As a consumer which is guaranteed the most secure water supplies, even in times of drought, it is correct that Eskom (and its customers) should pay for that privilege.

#### ■ *Health effects of air pollution emissions*

The analysis of the external costs of air pollution emissions on human health suggested that these costs are in the region of 0,54 c/kWh (range: 0,39 to 0,67 c/kWh). The central estimate represents approximately 4% of average electricity tariffs in 1994. Significantly, this estimate excludes a large number of externalities which may have significant costs, notably, the long-term effects of acidification on buildings, crops, forests and other objects at ground level.

There are numerous strategies which can be employed to address these external effects, including the setting of emissions limits, the specification of control technologies to be used, the introduction of pollution taxes or tradable emissions permits and self-regulation by polluters. It is beyond the scope of this study to analyse all these options and to propose suitable policies. Nonetheless, it is possible to make explicit some key implications of the analysis.

First, the order of magnitude of the health costs which currently occur are not insignificant and may merit consideration of abatement measures. Taking as a point of departure the current stock of coal power stations, the range of technical options for reducing gaseous and particulate emissions is relatively narrow. Commonly discussed in this regard are flue gas scrubbers, which could be retrofitted to existing power stations. There has not been any thorough public investigation to date of the economics of this technology option. Eskom's position on this has been that the costs of retrofitting its power stations with scrubbers are prohibitively high, at anything from 33% to 49% of prices (King and Rodseth 1993: 20), and that with costs of this order of magnitude, it is more effective to invest in electrification in highly polluted townships (Lennon and Turner 1992: 5).

Clearly, there are constraints on capital and investment resources which mean that investment decisions need to weigh up all alternatives, but it may be misleading to present air pollution abatement options as a direct trade-off between power station controls and electrification. Experience in recent years has shown that urban electrification does not lead to significant pollution reduction, and much less rural electrification (Eberhard and Van Horen 1995: 166). The national electrification programme is certainly not motivated by environmental concerns.

In assessing whether pollution abatement technologies are justifiable in economic terms, two sides of the equation need to be considered. The first is the cost of abatement: Eskom's analysis suggests that this would lead to increases in electricity prices in the region of 30% to 50%. This estimate is somewhat higher than experience elsewhere suggests: for example, Petrie et al (1992: 434) reported international experience of this cost penalty was in the region of 10 to 15%—therefore, taking this wider range, the cost

penalty will be in the region of 10 to 50%.<sup>29</sup> The second part of the equation is the benefit of abatement: this will consist primarily of the avoided environmental costs. The health costs quantified in this study represent 3% to 5% of electricity prices but, as noted several times already, this excludes several other impacts of air pollution. It could be expected that these costs would be reduced by up to 90% depending on the abatement technologies adopted; in addition, abatement benefits would also be felt in other areas not quantified here, such as reduced costs of acidification. It appears, therefore, from the orders of magnitude mentioned here, that the costs of abatement options do not necessarily outweigh the benefits by a large margin.

A range of technological options exist to reduce air pollution emissions: flue gas scrubbers are the most well-known of these, but are not necessarily the best option from an economic or environmental perspective. A more promising option is fluidised bed combustion: although this is a relatively young technology, life cycle cost analyses suggest that its performance is better than flue gas desulphurisation in most respects (Diekmann and Notten 1995). Possibly of great significance in South Africa's dry conditions is that scrubbers require large quantities of water for ongoing operations, and in the context of increasing water scarcity and higher water prices this represents a serious constraint.

With regard to fiscal instruments such as pollution taxes or tradable emissions permits, it would make little sense from an economic or environmental perspective to impose such instruments only on Eskom's power stations, without including other major sources of pollution. For such instruments to be adopted, an integrated policy is required in which all major pollution sources are included. Thus, in the absence of such a framework, this is not a feasible policy option at present.

#### ■ *Emission of greenhouse gases*

The international governance of greenhouse gas emissions and mitigation of their effects is a rapidly evolving arena. The current situation is that South Africa, if and when it ratifies the Framework Convention on Climate Change, will not face any specific emission reduction targets or obligations.<sup>30</sup> Thus, there is no immediate necessity for South Africa to introduce greenhouse gas mitigation measures at its own expense. A range of international funding sources—for example, the Global Environment Facility—exist to assist developing countries achieve reductions in their greenhouse gas emissions.

While it is clear from the international climate change debate that there is no question, for the present, of introducing a carbon tax or similar externality "adder" on South Africa's carbon dioxide emissions, this does not mean, however, that South Africa can afford to ignore the climate change issue. South Africa was the 18th largest source of greenhouse gas emissions in 1988, and one of the largest on a per

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<sup>29</sup> Clearly, variations in the base cost of electricity (the denominator) will influence the amount of the percentage increase.

<sup>30</sup> The future tense is used because, as at the beginning of 1996, South Africa had signed, but not yet ratified the FCCC.

capita basis (Van Horen and Simmonds 1995). The energy sector is the single largest source of greenhouse gas in South Africa; therefore, it has some responsibility to consider the effect of emissions. Also, it is possible that middle-income developing countries such as South Africa will face stricter commitments at some point in the not too distant future (Rowlands 1995b). If this is the case, it would be imprudent to ignore the relative impacts of different electricity supply options in terms of their climate change implications.

The quantification of externalities made it abundantly clear that the potential scale of damages is very large, and so the relative cost of more CO<sub>2</sub>-intensive energy sources will be considerably higher than other alternatives. This factor could be highly consequential when planning and investment decisions are taken around the country's next bulk supply option, given that coal is much more carbon-intensive than hydroelectricity or gas.

#### ■ *Subsidies to the nuclear industry*

The analysis of the fiscal subsidy to the nuclear industry showed that this amount averaged from 3,3 to 11,3 c/kWh, depending on the assumptions made about the future of the industry. Even in the most optimistic scenario, the subsidy represents about one-third of the current average price of electricity. On this basis, it is clear that nuclear electricity has historically been heavily subsidised, and will continue to be until the end of the life of Koeberg power station.

The externality calculations in this study reflect average external costs. From an economic point of view, an analysis of future policy options should be concerned with the marginal costs of various alternatives. Thus, the subsidy to the industry over the past 25 years is a "sunk cost": it has been expended and cannot be recovered. Policy analyses regarding the nuclear industry should, therefore, concern themselves with the cost-effectiveness of future investments and expenditure from public resources, and with the marginal environmental impact of future operations.

Thus the central question for policy-making purposes is whether the advantages of continuing to operate the country's nuclear facilities outweigh their disadvantages. Recent investigations of Koeberg's operating performance have raised serious questions about the reliability and effectiveness of its operations, thus underlining the need for a systematic and comprehensive investigation into the economics of the facility (Thomas 1996). An analysis of this question should be comprehensive and take into account all the future economic, environmental, social and other impacts related to the various options. In economic terms, all of the private and external costs should be included in the calculation: the latter include, for instance, society's valuation of risks of environmental hazards, catastrophes and so on. The absolute scale of subsidies which have historically been granted to the industry appear to be so large as to make it highly unlikely that they can be justified on economic grounds, especially when there are so many other sources of cheap electricity in the region. Of course, factors other than economically quantifiable ones will also enter the decision.

## Conclusion

Electricity prices play an important role in a resource-intensive economy such as South Africa's. Equally, any increase in prices which may come about as a result of shifting the burden of environmental costs from society at large to electricity producers and consumers, could have significant economic effects. At a microeconomic level, the price elasticity of demand (responsiveness to price changes) is relatively low in the short-term, for the principal reason that it is usually not easy to switch from electricity to an alternative energy source, particularly for large consumers.

In the longer-term, however, price levels may play a more significant role at the microeconomic level. This probably depends largely on the nature of the consumer, since electricity is a small input cost for most commercial, industrial and high-income domestic consumers and, so, they are more likely to absorb (and, where possible, pass on) price increases. For large consumers, however, even small price changes can have a major effect on their competitiveness: for example, gold mines and aluminium producers.

At a macroeconomic level, electricity prices have an important effect on GDP, inflation and employment, since electricity is an intermediate good which affects most sectors of the economy. In the short-term, any price increases can be expected to have a negative effect on these variables (Gibson and Van Seventer 1995).

In the longer-term, however, it is less clear what the effects of higher electricity prices are on macroeconomic performance. Two of the most successful economies in the world, those of Japan and Germany, were built up after the devastation of World War II, with energy prices among the highest in the world. This is not to suggest that their successful economic performance was a result simply of high energy prices—clearly it was not—but to point out that cheap energy prices will *not necessarily* be in South Africa's best interests in the long-term, especially if these lock the country into a capital-intensive and resource-intensive development path as opposed to a higher value-added route.

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## chapter 3

# CATALYSING CHANGE

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## International environmental pressures on South African exporters

Lael Bethlehem

### Introduction

Environmental concerns have become an established feature of international trade. Consumers around the world (but especially in Europe and North America) are increasingly making choices on the basis of the environmental impact of products. Governments are imposing restrictions on what can be brought into their countries, and multilateral bodies, ranging from the World Trade Organisation to the United Nations and the International Standards Organisation (ISO), are making agreements that regulate the environmental aspects of trade.

At the centre of the trade and environment debate is a problem about how to regulate environmental impact. Each country imposes different environmental laws on its own producers, and environmental standards differ radically between countries. But when countries trade with each other they import not only a product or service, but the embodiment of a production process. The product produced in the exporting country may have very different impacts on the environment—either on the local environment in which it is made, or on the environment of the country into which it is imported and eventually disposed. Given that the actual harmonisation of environmental standards between countries is very difficult, countries have found other ways to influence the environmental performance of companies from which they import. Sometimes this is done through international agreements such as the Convention on International Trade in Endangered Species, which controls trade in wildlife products, or the Basel Convention, which regulates trade in hazardous waste. Domestic regulations represent another mechanism which has been used particularly successfully by the European Union to control the entry of products which may be environmentally damaging. Eco-labels influence companies to modify their production by providing market incentives for producers to meet certain environmental requirements. International management standards are another way to get producers internationally to meet certain environmental requirements.

But what impact does this have on exporters, especially those in developing countries? Are these international pressures helpful ways to nudge exporters towards higher environmental standards? Or are they ways of excluding exporters and providing protection for more sophisticated northern producers? Indeed, do exporters in developing countries have the financial, human and technological resources to meet the new environmental requirements? Will the international environmental agenda prove to be a catalyst that raises standards in the South, or a constraint to developing country exporters?

This study attempts to explore these questions in the context of South Africa. For a country like South Africa, environmental trade measures are fraught with dangers. The country's balance of payments constraint is a key factor in determining its development potential. South Africa's export patterns are currently undergoing a major change stemming from the long-term decline in gold exports, and there is pressure to increase semi-processed, agricultural and manufactured exports. If major constraints are placed on South Africa's ability to export such goods as a result of environmental trade measures, this could have a serious impact on the country's economy.

There are certain specific features of the South African economy which could make the country vulnerable to environmental measures. Firstly, it has a high concentration of energy-intensive industries and many of these are active in export markets. These industries draw their energy from coal-fired power stations and enjoy the lowest electricity prices in the world. Any action against coal-fired energy (for example, as a result of greenhouse gas emissions,) could have a significant effect on exports. Secondly, due to the low levels of investment in the South African economy (and particularly in manufacturing) from the mid-1980s to the early 1990s, capital stock in industry tends to be old. As a result, environmental protection technologies that have been built into newer capital equipment are often missing. The investment required to install these in some sectors is considerable and may place a large burden on companies in certain industries. Thirdly, the environmental regulatory system is weak and environmental standards in many sectors are lower than they might be with better enforcement of environmental regulation. South Africa may be particularly vulnerable, then, to trade-based environmental measures.

But international environmental pressures may also benefit South Africa by raising the environmental performance of South African exporters. Although environmental pressures are growing in South Africa, the levels of regulatory, consumer and civic pressures on industry are still much lower than they are in developed countries. Processes are currently under way to re-examine environmental legislation and to find ways of redesigning regulatory institutions. But this will take time to implement and will always be subject to resource constraints. In the face of regulatory weaknesses, perhaps environmental trade measures will be helpful because they will exert pressure on export companies to ensure that they raise their environmental standards more quickly and decisively than they would otherwise. In theory, then, environmental trade measures may be seen as a double-edged sword which is as capable of damaging South Africa's process of development as it is of improving exporters' environmental performance.

But what is the reality faced by South African exporters? Given the international debate and the potential impacts that we have identified in theory, what are the experi-

ences and expectations of companies active in the export market? This study set out to explore these experiences by interviewing 20 export companies in 12 sectors. The companies were interviewed not only about strictly defined trade measures, but about the effects of all forms of international environmental pressure. These include international labels and management standards, consumer preferences, eco-labels and the effects of international environmental agreements.

The 12 sectors selected for this study represent a sample of South Africa's largest exporters and include energy-intensive exports, commodities, agricultural and manufactured exports. Some sectors were chosen because their products, such as timber, are especially sensitive to environmental pressures. Others, such as packaging and energy generation, were included because of the critical role they play in servicing exports. Data from the South African Foreign Trade Organisation was used to select large exporting companies in each of the sectors. In most cases two companies were interviewed per sector. While this does not provide a comprehensive look at each sector, it does give us some idea of the dynamics relating to international environmental pressures. The sectors selected were:

- aluminium;
- coal;
- chemicals;
- electricity generation;
- fruit;
- minerals processing;
- packaging;
- pulp and paper;
- steel;
- soaps and detergents;
- textiles; and
- timber.

In each case a face-to-face in-depth interview was conducted. In most cases the export manager of the company was interviewed and where this was not appropriate—for example, packaging and electricity generation—the environmental manager was approached instead. In some cases both the export and environmental managers were interviewed.

## Sectoral experiences

This section presents a summary of the main issues in each sector as they were revealed in the interviews. The discussion focuses on the environmental pressures reported by the exporters in the sample and on their expectations of how these measures are likely to develop in their sectors. For the most part, the sectors are presented in alphabetical order. However, the discussion of the electricity generation sector is presented first because the issues raised with regard to electricity generation provide important background information for a number of other sectors. For the same reason, the discussion of the electricity sector is longer and more complex than the others.

## **Electricity generation**

Eskom, the public utility responsible for generating and distributing electricity, was the company interviewed in this sector. Eskom<sup>1</sup> provides over 95% of the electricity consumed in South Africa, the bulk of which (about 90%) is supplied from coal-fired power stations mostly located on the Mpumalanga (formerly the Eastern Transvaal) Highveld. There is also one nuclear power station and two hydroelectric stations but the latter are only used for peak demand purposes. The nuclear and hydroelectric stations will not be dealt with in this chapter since they contribute such a small percentage of electricity supply.

Electricity provision in South Africa is unusual for two reasons. Firstly, a very high proportion of our energy is provided by coal-fired electricity as opposed to a greater mix of supply. Secondly, our electricity is very cheap. At present Eskom supplies the world's cheapest electricity to high-load users and has committed itself to lowering the real cost by a further 15% by the year 2000. In addition, Eskom currently has an over-supply of generating capacity. These factors make South Africa an attractive place in which to establish energy-intensive industries. South Africa's large and fairly easily accessible coal reserves will ensure that cheap, coal-fired electricity is available for many years to come.

But coal-fired generation has an important impact on the environment, especially in terms of air quality, water quality and consumption and waste. Coal-powered stations use large quantities of water and impact on water quality. The stations also generate large quantities of ash (22 million tonnes in 1994) and small quantities of hazardous waste.

All of these clearly impact on the environment and on human health in South and southern Africa. But for the purposes of this chapter we will concentrate on those that are of global concern, since they are most likely to affect trade issues. This means focusing largely on air emissions. The concerns that are currently most strongly on the international agenda are the emission of greenhouse gases (especially CO<sub>2</sub>), substances contributing to ozone depletion (chloro-fluorocarbons—CFCs) and substances contributing to acid rain (SO<sub>x</sub>, NO<sub>x</sub>). Greenhouse gases, in particular, have come under the international spotlight because of concerns about the potential effects of global warming. In 1990 South Africa emitted 1.4% of global CO<sub>2</sub> emissions and Eskom was the single largest contributor to this. In 1994 Eskom power stations emitted 143 million tonnes of CO<sub>2</sub> (Eskom 1994).

Within the context of continued use of coal-fired stations, Eskom has limited options for abatement of CO<sub>2</sub>. It is impossible to prevent the emission of CO<sub>2</sub> from a coal-fired station altogether, although it is possible to become more efficient so that less CO<sub>2</sub> is emitted per unit of electricity generated. Even with improvements in efficiency, however, CO<sub>2</sub> and other gaseous emissions will continue to rise in absolute terms as the demand for electricity rises.

With regard to the emission of SO<sub>x</sub> and NO<sub>x</sub> (which may contribute to acid rain and respiratory illness), Eskom has taken a decision not to install equipment to remove these substances. Although such technologies are available, they are extremely expensive and

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<sup>1</sup> Although company names are generally not mentioned in this chapter, Eskom's name is mentioned as it is the only company in the sector. It is, therefore, not subject to the same competitive concerns as companies in other sectors.

they are especially expensive to retrofit to existing stations as opposed to including them in new stations. Eskom argues that:

In the Eastern Transvaal Highveld, the main power generating region of South Africa, concentrations of ground level pollutants (sulphur oxides, nitrogen oxides and particulates<sup>2</sup>) are lower than the air quality guidelines recommended by the Department of Health. Whilst the situation will continue to be monitored, Eskom believes that, given the declining concentrations of the pollutants in the general atmosphere, the cost of installing equipment to remove sulphur and nitrogen oxides is not justified (1994:17).

The introduction of environmental abatement technologies is, of course, related to the price of electricity. Cheap electricity is an important comparative advantage for South African industry and, indeed, Eskom is actively promoting the establishment of energy-intensive sectors (such as aluminium) in South Africa. However, as Van Horen has argued, the low electricity price may reflect inadequate environmental investment (see chapter 2).

Eskom has a clear programme to manage its environmental impact and has identified environmental management as a priority issue at a senior management level. The Eskom environmental report was first published in 1994 and was an important step forward in establishing transparency and providing information on the company's environmental impact. However, this does not necessarily mean that the environmental impact of electricity supply is being adequately addressed, or that trade pressures will not come to bear as a result.

Eskom's environmental impact, and the concentration of electricity intensive industries in South Africa, make our electricity-intensive sectors potentially vulnerable to international trade pressures. Eskom has recognised this issue and Eskom chairman John Maree has noted that:

Trading partners are increasingly asking about the environmental credentials of South African products. We must therefore ensure that electrical energy is generated, supplied and used in an environmentally responsible way (Eskom 1994: 3).

In our interview, however, Eskom said it had not been under any pressure from its electricity intensive export customers with regard to its environmental performance but that international environmental pressures were reaching the company in other ways. Eskom is acutely aware that greenhouse gas emissions are firmly on the international agenda and have the potential to impact on South Africa's trade relationships. But so far Eskom seems to be adopting a wait-and-see attitude, arguing that:

Current scientific evidence regarding global warming is inconclusive. However, the changing international position and research on issues such as global warm-

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<sup>2</sup> Particulate emissions are not discussed in detail in this chapter because particulates do not fall within the current international agenda. However, it should be noted that particulate emissions are an important contributor to respiratory illness and may, therefore, be seen as a major externality. Some methods are available to reduce emission of fine particulate matter and Eskom is experimenting with the introduction of such technologies, including bag filters. A recent failure of bag filters at the Duvha power station has, however, led to concern about the prospects of addressing particulate emissions in this manner (Allen 1995:13). For a fuller discussion, see Van Horen in this volume.

ing are being monitored. Eskom also contributes to the development of the South African strategy on the Framework Convention on Climate Change (*ibid*:16).

The Framework Convention on Climate Change (FCCC) sets out a programme to limit greenhouse gas (and, in particular, CO<sub>2</sub>) emissions internationally. At present, a small number of mostly developed countries contribute the lion's share of CO<sub>2</sub> emissions. In 1990, for example, the USA alone contributed 23% of global CO<sub>2</sub> emissions. There is, however, no clear relationship between a country's level of development and its emissions. For example, in 1990 Japan and Germany each contributed 5% of global CO<sub>2</sub> emissions compared with the USA's 23%. China and Russia each contributed 11% and the UK contributed 3%. South Africa's emissions were about one-third higher than those of Brazil, which is a much bigger country at a similar level of development.<sup>3</sup>

The FCCC distinguishes between developed and developing economies and assigns different responsibilities to the two groups. South Africa is now a signatory to the convention and is classified as a developing country.<sup>4</sup> As such, our immediate responsibilities do not involve setting targets for reductions in emissions but rather commits the country to:

- sharing of information on emissions;
- tracking carbon sources and sinks; and
- developing a strategy to reduce emissions.

There is, therefore, no immediate pressure to substantially reduce our greenhouse gas emissions. Instead, we need to establish information systems and develop a strategy for the future. In the medium-term, however, South Africa is likely to come under some pressure to limit greenhouse gas emissions since targets and other commitments may be set for middle-income developing countries.

South Africa remains vulnerable, then, to potential international action on CO<sub>2</sub> and other greenhouse gas emissions and to potential action on other issues. Already, international development aid is being linked to environmental—and, especially, climate change—issues, and they also have a high profile on the agenda of the multilateral organisations. For these reasons the environmental impacts of South Africa's energy generation remain on the agenda.

## **Aluminium**

Two companies were interviewed in this sector. The first manufactures primary aluminium and exports about 50% of its product, mainly to Japan, Korea, Malaysia, the Middle East and Africa. The second produces rolled aluminium products and extrusions and exports about one-third of its production, mainly to North America and East Asia.

Both companies were aware of a range of general environmental pressures, including local regulation of emissions and effluent. However, neither company had experienced significant pressures in the export market. Both companies were aware of the discussions

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<sup>3</sup> Figures cited in Escom 1994:16.

<sup>4</sup> South Africa has signed, but not yet ratified, the convention and, as such, is not yet a member of the Conference of Parties. Government expects to ratify the convention early in 1997.

on the development of an environmental standard under the ISO<sup>5</sup> and both expected to apply for accreditation once the standard is in place. One of the companies had been asked to provide information on its environmental management system to one of its customers as part of the customer's own efforts to qualify for the British environmental standard (BS 7750). The company was able to provide the information required and did not suffer any loss of business, but acknowledged that it may need to re-examine its processes to ensure that this kind of customer requirement can be met. Both companies were aware of a general increase in environmental pressures and perceived the international industry to be increasingly concerned about environmental issues. One of the companies was, for example, in the process of developing a comprehensive environmental policy, partly to prepare for a major new investment. The company felt anxious to "cover our environmental bases" before the investment could be finalised because "we can't afford to trip up on the environmental question". Both companies had also experienced pressure from export customers to reduce and redesign their packaging.

The aluminium sector is vulnerable to international environmental pressures because it is extremely energy intensive. In the production of primary aluminium, energy costs account for some 35% of unit production costs. This is especially important for one of the companies, since the price it pays for electricity is pegged to the international aluminium price. In this way, its electricity costs remain stable relative to the price of its product, and this is a major advantage. Any attempt to restrict trade access on the basis of "dirty" energy would have a major impact on the aluminium sector. However, neither company seemed to be aware of this possibility and there have been no threats of action or even queries regarding the environmental performance of their electricity suppliers so far. While both companies acknowledged the potential dangers, they argued that the issue had not arisen for them so far and had not been identified as a strategic issue at senior management level.

## Chemicals

Two companies were interviewed in this sector. One is a producer of a wide range of chemicals and chemical products. Its exports are concentrated in particular product markets, some of which are exported in large quantities—up to 40% of production—mainly to the EU, North America, Latin America and Australia. The other is a producer of petrochemicals and general chemicals. It is currently attempting to raise export levels and is especially active in the EU, North America, Latin America and East Asia.

Neither company has experienced strong pressures or restrictions to market access. However, both companies have received queries about potential hazards involved in the use and degradation of their products. Both have been asked to fulfil special protection and labelling requirements for the transport of their products, and this has required specialised

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<sup>5</sup> The ISO, which manages the ISO 9000 quality series and other standards, has recently established a standard for environmental management systems called ISO 14001. When these interviews were conducted, ISO 14001 was not yet in place. Other environmental standards will be formulated as part of the ISO 14000 series.

packaging. Both are aware of or involved in the discussions on the ISO 14000 series and both expect to apply for accreditation. Both companies see environmental issues as increasingly important to their ability to capture and maintain export markets in the long-term. For example, one company said:

We are looking to cleaner technologies, waste minimisation and utilisation of by-products. We don't want to be at a disadvantage in the international market as a result of environmental issues. We are also trying to identify products which may be able to capture markets as a result of special environmental features such as biodegradability. We are also concerned to avoid accidents or other problems which, aside from anything else, would be a major problem in international markets. We don't want to be seen as irresponsible.

One area where the sector has made a major adjustment is in the process of removing CFCs from their production. Action was taken in the wake of the Montreal Protocol—and in line with national policy—to phase out CFC production. This involved making changes to a variety of processes.

Both companies believe that there will be increasing environmental pressures in the sector and that, internationally, companies will assume more and more responsibility for their products, from cradle to grave. The companies pointed to various environmental initiatives in the sector internationally and argued that South African companies are keeping pace with world trends. One example of this is the trend towards more transparent environmental reporting. New forms of environmental reporting are being considered in the industry, with one of the companies considering producing an annual environmental report in addition to the usual annual report.

But keeping pace with international trends can involve large investments. One of the companies has decided that all new plants in the group will be built to international environmental standards, partly to ensure that products are able to meet the requirements of the export markets. But older plants present more of a problem because of the cost of retrofitting. One of the companies is considering retrofitting electrostatic precipitators and bag filters on some of its older plants in order to control sulphur and particulate emissions. This is, however, "tremendously expensive. The question is whether it will become a cost of staying in business." Since there are a significant number of old plants in the industry we can assume that the investment requirement for environmental upgrading in this sector will be large. It is by no means clear, however, that in the short-term (and in the absence of stronger local or international pressures) the companies will choose to make these investments. As one environmental manager in the industry put it:

It is difficult to justify environmental projects because they don't generate any extra income. The accountants just see them as raising our fixed and operating costs without providing any real benefit to the company. We have been most successful in convincing senior management to make an investment when we have been able to recover a by-product which can then be sold. But otherwise it is difficult to make these investments.

The chemical sector, more than most, faces environmental problems both here and internationally and is affected by international conventions and environmental campaigns. Both

companies pointed to international conventions and campaigns that affect them, including the Basel and Bamako conventions (which regulate the transport of hazardous waste), the FCCC (which regulate the emission of greenhouse gases) and the Biodiversity Convention. One of the companies is particularly concerned about the potential impact of the FCCC since it produces and emits large quantities of CO<sub>2</sub> and other greenhouse gases. Indeed, the sector as a whole is a major contributor to such emissions. The chemicals industry would have to be integrally involved in any plan to reduce greenhouse gas emissions under the FCCC or any other plan.

The industry is also affected by the international Greenpeace campaign to ban the use of persistent chemicals such as DDT, PCBs and chlorine. According to the companies, the dangers of DDT and PCBs have been widely recognised and their business would not be severely affected by an international ban or restriction on their use. Other persistent chemicals like chlorine and polyvinyl chloride, however, are much more integral to the business of the chemical industry as it is currently structured and severe restriction would have "a major impact on our business".

According to the interviews, the South African chemical industry, and the large companies in particular, are following international trends and are in no immediate danger of losing export markets as a result of environmental measures. The industry is experiencing a combination of pressures from local sources—regulations, environmental action groups and potential liability—and international sources—export customers, international environmental campaigns and international conventions. These are driving the sector to be increasingly aware of environmental concerns. However, if companies are not able to meet environmental concerns and keep up with international trends, they may face difficulties in export markets in the long-term. This will be especially true of newer or smaller exporters who may have greater difficulties in meeting the investment and administrative requirements that often accompany effective environmental management systems.

Parts of the industry also face particular challenges with regard to greenhouse gas emissions and attention will need to be given to this in the future.

## Coal

One company was interviewed in this sector. It is a major coal producer and exports 30% of its production to a variety of markets in the EU, East Asia, North America, Latin America, the Middle East and Africa. The company is aware of growing environmental concerns in the industry:

There is no real pressure at this stage, but from time to time we are asked about our environmental policy. Some customers are beginning to look at our performance in more detail, such as looking at trace elements in our product. There is general desire among companies internationally to demonstrate that their suppliers act responsibly in relation to the environment and this is affecting us. Most of the queries we receive are informal but we have recently received some formal enquiries about our environmental impact.

The company is involved in various task groups looking at the development of the ISO 14000 series of environmental standards and is likely to apply for accreditation under ISO

14001. Internationally, coal is largely used as an input to the electricity sector and coal-fired power has come under some pressure with regard to its environmental impact and, especially, its contribution to greenhouse gas emissions and acid rain. This pressure may, in the long-term, affect international coal consumption. At present, however, international coal consumption is not being negatively affected. The world market for coal is expected to grow by about 30% by the end of the century and South Africa's coal exports are likely to follow the trend. The world coal market is, however, increasingly demanding low-sulphur coal because of concerns about sulphur emissions and because of regulations such as the USA's Clean Air Act. South African coal deposits are low in sulphur and this places South Africa at an advantage relative to many competitors. In time, the company expects to earn a premium on the world price because of the low sulphur content.

The coal sector is potentially vulnerable to environmental trade measures, especially in the form of a carbon tax. The company does not, however, expect carbon taxes to be widely introduced in the foreseeable future. It argues that:

The talk of a carbon tax is really more of a stick to beat coal suppliers than a serious environmental initiative. Of course we need to be concerned about carbon levels, but we also have to ask: what real alternatives are there to coal-fired energy, given installed international capacity and price? If you take these factors into account, it seems very unlikely that the use of coal will decline significantly. This is borne out by the fact that international demand for coal is still increasing and there are robust plans for coal-fired plants in East Asia and China in particular.

So we are not expecting a decline in demand.

If international coal consumption does decline in the long-term, South Africa could be badly affected since coal is a major export and, indeed, a major employer. However, we would be in a slightly better position than many other coal exporters due to the relatively lower sulphur levels in our coal.

### **Minerals processing**

Two companies were interviewed in this sector. One produces manganese and exports 85% of its product. The other produces platinum and related products and exports over 90% of its product. Both export to a wide range of markets including the EU, North America and East Asia.

Both companies have received some queries about the environmental performance of their products and processes and both believe that the issue is becoming increasingly important in international markets. Neither company has, however, faced environmentally related market barriers so far. One of the companies was aware of ISO 14000 and expected to apply for ISO 14001 accreditation. This company argued that although there is no significant pressure in export markets so far, it is likely to increase:

We are trying to be proactive. We hope to achieve what we need to long before the pressure becomes visible and certainly before it becomes unbearable. We know that it makes sense for our competitors to jump on the environmental bandwagon and the Greens are also becoming aggressive. Just look at the campaign against Shell in the North Sea. We are, therefore, trying to make sure we have our house in order.

One of the companies has experienced a particular problem with exporting one of its concentrates which contains recycled materials. There has been difficulty in passing through European borders because of intricate regulations relating to this product and its environmental implications. According to the company:

There are lengthy forms for concentrates containing recycled materials and this has led to cost and time delays as well as some consignments not being accepted. We believe that the bureaucratic hurdles are not just for environmental reasons but that our competitors assisted in putting them in place. Also, the forms we have to complete require signatures from officials in government departments and our cause has certainly not been helped by the inexperience and confusion in some of the departments. While these problems are being sorted out here our competitors are outflanking us in this particular market.

Companies in this sector also point to the cost implications of investing in technologies necessary for environmental protection. One of the companies, for example, recently decided to upgrade its effluent systems in order to deal effectively with environmental concerns. This will cost R60 million—R70 million over three years for one plant alone. The investment does, however, allow the company to recover some materials and this will offset the costs to some extent. The company pointed out that if environmental costs "hit all international producers simultaneously, it will just be added to the cost of the product". If, however, some producers have fallen behind or have special environmental problems, they may be at a disadvantage in international markets. Given the generally old capital stock in South Africa, this could become a major burden.

Environmental issues are becoming more prominent in the industry and, as with the chemical sector, this seems to stem from a combination of local and international pressures. One of the companies pointed out that until two years ago it dealt with environmental issues fairly informally but now it has been identified as a major strategic issue for the next decade, especially with regard to exports. The company has established an inventory of environmental issues and created an action plan to address them.

Perhaps the biggest danger for the industry relates to the energy issue. Like aluminium, energy costs are a large proportion of the cost of minerals processing (around 30%). South Africa's cheap electricity is currently a major advantage but may also become a disadvantage if there is international action against greenhouse emissions. Only one of the companies was aware of the issue. It felt that there is no immediate danger.

We think that the West is quite embarrassed about its own emissions and is unlikely to push the CO<sub>2</sub> issue too hard. CO<sub>2</sub> is related to a country's level of industrialisation and ours is much lower per capita than the developed countries. So we are not too concerned. For us, SO<sub>x</sub> and NO<sub>x</sub> emissions seem much more important but they are not really being driven by an international agenda.

### **Citrus fruit**

One company was interviewed in this sector. It is an export agent that markets South African citrus fruit on behalf of farmers and sells to a wide range of countries including the EU and North America. According to the company, environmental issues are coming up

strongly in the international fruit trade and the company has identified environment as a major issue over the next five years. Fruit is subject to specific sensitivities and to special provisions applicable to food. The major issue in the industry is the use and control of chemicals that are used in growing and transporting the fruit. The regulation of chemicals has become a major issue in the industry internationally and this has had an immediate impact on South Africa since exports constitute some 60% of the crop. South African exports, particularly to Europe, must meet with strict specifications on chemical residues in fruit entering the market. This has meant that South African farmers have had to alter their methods of protecting the fruit both during growing and distribution. This has involved reducing chemical controls:

There have been a number of factors encouraging a move away from certain chemicals and towards more natural controls such as introducing beneficial insects. We are now on the path towards integrated pest management which involves a combination of chemical and biological controls. The issue of chemical residues in fruit entering the export market has probably been the most important factor pushing us in this direction.

Indeed, the company has been key in conducting research and introducing new management techniques to the individual growers. The company assists farmers with introducing these techniques and with managing pesticides and other chemicals. This is especially important since farmers who abide by South African law may still be unable to export their product. According to the company, "you can meet all the requirements of South African law and still not be able to export your fruit". Part of the difficulty has been that local standards for chemical use do not necessarily take account of maximum residue levels applicable in export markets. In response to this problem, the company issues publications for farmers which specifies restrictions on chemical use for export markets. Since exports are a high percentage of local production, most farmers have introduced these new methods for all their produce and not only for their export fruit. This is an example, then, of international trade driving improvements in local management practices.

In addition to regulations in other countries there are now certain customers who demand standards that are higher than their domestic regulations. For example, there is now a niche market in Japan for fruit which is totally free of chemicals and this has encouraged some South African producers to experiment in this area.

## Packaging

Two companies were interviewed in this sector. Both are large packaging groups which provide packaging services to a wide range of exporters in various international markets. Both companies also export some empty packaging, mostly to Latin America and the EU. Both companies have been highly involved in meeting the packaging requirements of their customers in export markets. In particular, they have had to respond to EU packaging regulations and the effects of the German Packaging Ordinance have been especially strong.

The issue of packaging South African exports has been well-documented and will not be covered in detail here. What is important to note, however, is that international (and especially European) packaging legislation has driven significant changes in the local

packaging market and has encouraged a trend towards lighter and more easily recycled materials. According to the companies, this trend is now not only evident in packages for export products but also for locally used packaging.

The packaging experience also illustrates the importance of services to exporters. One of the companies gave the example of an exporter who received a 14 - page questionnaire on the environmental consequences of his export packaging.

They got the fright of their life but because we had developed an expertise in the area we were able to assist them. If South African packaging companies had been unable to meet the new packaging requirements, all our exports would have been threatened. But we have been able to meet the challenges and expect to continue to do so. In export markets you have to do as you're told.

Similarly, the packaging experience illustrates the way in which environmental trade measures can drive company behaviour all the way down the line. "Companies have become more and more demanding of the environmental performance of their suppliers and packaging is certainly part of this trend."

### Pulp and paper

Two companies were interviewed in this sector. They are large producers of pulp and paper and export some 35% of their production. Exports are concentrated in particular product markets and are sent to a wide range of markets including those in the EU, North America, Africa and East Asia. Environmental pressures have been particularly strong in this industry and it serves as an interesting case study of the capacity of international market trends to change the environmental behaviour of South African companies.

There have been two main concerns about the environmental impact of the pulp and paper industry in recent years. The first is the impact of wood demand on world forest resources. Here the concerns have mostly been about logging of old-growth forests and the contribution of the paper-related wood industries to deforestation. The source of pulp producers' timber supplies and the management of forests have, therefore, come under the international spotlight. The second main concern has been about the use of chlorine—particularly elemental chlorine—for the bleaching of pulp and the subsequent release of organochlorine effluent into inland and marine waterways. As a result, there has been an international campaign to remove chlorine from the paper-making process. In a number of countries, most notably Germany, consumer markets have demanded chlorine-free paper, and certain German retailers have refused to sell paper which contains chlorine. This has had a major impact on pulp and paper production internationally.

The forestry and chlorine campaigns have both affected South African companies. Both companies have had enquiries about their timber sources, with some customers asking for written certification that the wood used in their paper production is not logged from old-growth forests. This has, in fact, been an advantage for South Africa since all pulp wood is drawn from human-planted, managed forests rather than indigenous areas. There are a number of environmental problems associated with plantation forests of this kind—particularly their impact on water supply and biodiversity—but these have not yet come under international scrutiny. The chlorine issue has been more difficult for South African

producers. Although a South African paper company invented a technique to remove elemental chlorine from the bleaching process some 20 years ago, elemental chlorine is still being used in some South African plants. The international market is, however, increasingly demanding elemental chlorine-free pulp and, as a result, both companies are moving in this direction. One of the companies commented:

By the end of 1996 all our plants will be elemental chlorine-free and this has been driven entirely by exports. In one case we wanted to delay the transition to elemental chlorine-free by two years but we were forced to move more quickly. Of course, it is incredibly expensive. We have spent R65 million on this already and there is still more to go as we still have to adapt our largest mill. There is no added value as such—in fact, it creates additional operating expenses as well as capital costs. But in this case it is a cost of staying in business.

In fact, some markets are now demanding pulp that is not only free of elemental chlorine but totally chlorine-free. The totally chlorine-free movement is gaining strength in Europe and particularly in Germany and Scandinavia. The USA has, however, strongly resisted this trend and there seems to be little pressure from East Asia. However, since Europe is a large destination for South African pulp exports there is some prospect that South African producers will need to move in this direction.

The chlorine issue is an interesting example of market-based pressure. According to the companies there is no agreement among scientists internationally that chlorine is, in fact, harmful in the quantities in which it is released. However, the market has made a judgement that it is harmful and this has been impossible for pulp producers to ignore. It is also an interesting example of the way in which companies can use environmental performance as a source of competitive advantage and perhaps as a source of protection. One of the companies cited an example of a Scandinavian pulp company which is seeking to push environmental standards as high as possible:

All their pulp is totally chlorine-free and they are trying to make this the standard for the European market. But the truth is that the Scandinavians are high-cost producers and the only way that they can differentiate themselves in the market is through environmental factors. They could end up using this as a trade barrier. For example, some of the companies are moving towards becoming altogether effluent-free, so the goalposts keep moving.

The chlorine case also demonstrates the limited impact of international market-based pressures. There are two reasons for this. Firstly, environmental pressures rise and fall to some extent with supply and demand in the market, especially in relation to commodities. At times of international oversupply, customers are able to exert more pressure on suppliers and can be more insistent about environmental issues. When the market is tighter, customers tend to ask fewer questions about environmental performance as they are under more pressure to assure their supply. Secondly, the international market is concerned only about certain issues, usually those involving global commons. While other, more local, environmental issues may be more urgent, they are unlikely to receive international attention. International pressures must, therefore, be combined with effective local regulation. For example, one of the companies has recently been under pressure to reduce its marine

effluent, but his has come from local rather than international sources.

The pulp and paper industry has certainly been targeted internationally and it seems that the pressure will continue. The companies both perceive various forms of environmental certification to be critical to their ability to export in future. These include ISO 14001 and EMAS (a European standard). There is also a strong possibility that a European eco-label on paper will be developed. Long-term issues for the industry include the possibility of effluent-free production as well as alternative (non-wood) sources for paper-making fibre. Said one of the companies: "Given the way that the international market has gone, I wouldn't discount either of these as possibilities in the long-term." If either of these materialised, new costs would be imposed on producers and some of South Africa's comparative advantage—for example, from fast-growing wood—may be eroded. This suggests a need for South African producers to maintain a competitive advantage in all aspects of their production, including the environmental aspect, rather than simply relying on raw material advantages.

## Steel

In this sector an interview was conducted with an environmental representative, who is also a manager at a large steel company, of the industry body.

The steel industry exports some 30% of its production to a range of markets including Latin America, the EU, East Asia and the USA. Exports include mild steel, flat products, profile products and stainless steel. The industry is experiencing increasing environmental pressures from local sources and from the international market. The pressures from the international market, in particular, are expected to grow in coming years. "We have had no formal enquiries so far but we are expecting them any day. We have received some international visitors who have asked questions about our environmental performance and we have also been asked to fill in various forms for some of our customers."

Recently, representatives of one of the major companies in the industry visited European customers and competitors and gained a clear impression that environmental pressures are growing in the international market. They also concluded that South African companies are largely behind other international producers on the environmental front although some local mills perform better than others on this score. The international industry has already been through major environmental changes but these are still fairly new for South African companies.

It is difficult to generalise about the environmental profile of the industry. Much depends on the age of the mills and the degree to which they have invested in capital equipment which limits their environmental impact. One recently constructed plant is seen as state-of-the-art in all aspects including environmental performance, but many other plants are very old and lack environmental protection technologies. Two of the country's largest plants are also its oldest. It is these plants that are most vulnerable to environmental pressures. One plant, for example, was built 51 years ago and although it has been upgraded it still lacks sufficient environmental protections. "When this place was built, there was very little concern about pollution and many of our batteries are simply not up to today's standards." But the investments required to upgrade these old plants are very costly. At one plant alone, an investment of R1,5 billion is being considered, largely for environmental reasons

although it would also have benefits in terms of efficiency. "We tend to find that the senior management are reluctant to make investments that are purely environmental and have no economic benefits."

If this and similar investments are not made, it seems that some of South Africa's mills may face real threats in the export market. In the industry as a whole, environmental investment levels are low at about 5% of operating budget compared with an international average of about 15%.

In the older mills we will probably have to spend something like 30% of our budget for a few years in order to catch up. The way I see it, there is a race against time. Its all right now when there is an international shortage of steel but when the market turns everyone will be trying to sell their steel and then environmental pressures will pop out like *soetkoek*.<sup>6</sup> If we can't improve I think we will probably lose some export markets.

The company is working towards ISO 14001 and believes that accreditation will help in the international market. Although the ISO standard will not necessarily ensure that all environmental problems are addressed, it will impose some pressures. "The ISO 14001 standard is likely to be based on action plans, so in order to qualify you have to be doing something to solve your problems."

The steel industry is also under some pressure from local sources. This includes pressure from surrounding communities to do something about air emissions. There is also government pressure as a result of the presence of chemicals and heavy metals in plant effluent as well as concern about particulate and sulphur emissions. The international pressure may, however, be more difficult to resist:

The truth is that you can always pay a fine and carry on, especially since our fines are very small. But if your customers are complaining there is nothing you can do. You can survive anything else but you can't survive without customers.

The steel industry, therefore, faces major environmental challenges and without substantial action and investment may well face constraints in the export market in the coming years. There may be some value in developing an industry-level approach to this problem and some assistance from government may be required. In particular, it may be useful for an organisation like the Industrial Development Corporation to make preferential finance available for exporters who are struggling to make the necessary environmental investments.

### **Soaps and detergents**

Two companies were interviewed in this sector. Both are subsidiaries of major international companies. Each company exports less than 10% of its production, mostly to other African countries and to the Indian Ocean islands. What is interesting about this sector for our purposes is the effect of the policies of the head offices of these multinational companies on the manufacture of products in South Africa. Both companies must abide by the

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<sup>6</sup> Sweet cakes.

policies set by their mother companies and the environmental performance of their products must match the same standards as a product manufactured in a company plant in another country. One example of this is in packaging. At one of the companies, the international head office set packaging policy guidelines which exceeded local regulation or practice in the South African market. The local subsidiary then had to ensure that its packaging suppliers were able to meet these standards and that its packaging for local and international markets was in line with the company's international policy.

Both companies pointed to a relative lack of environmental pressures in the local market or through local regulations. "Internationally, environment is a big issue but here there is very little pressure. For us it is more of an issue coming from the global company policies than from the local situation."

However, the policies of multinationals do not necessarily ensure that environmental standards are equivalent in all cases. One of the companies, for example, displayed a product from a sister company in Europe. Information written on the pack provided a substantial amount of environmental data including information on the biodegradability of the product and on the recycled content of the package. Similar information is not available here although the product itself is almost identical. The companies also have some experience of direct pressure from customers. One of the companies won a United Nations tender to supply products for an aid organisation working in central Africa. The customer required substantial information about the product, including its environmental performance, in order for the tender to be awarded.

In summary, companies in this sector are probably achieving higher environmental standards than they would in the absence of pressures from their multinational head offices and face no immediate threats on the export front.

### **Textiles**

Two companies were interviewed in this sector. One is a large producer of a range of textiles and exports 10% of its product mostly to the EU and Australia. It has only been in the export market for two years and hopes to grow its exports to 20% over the next five years. The second company produces technical and engineering fabrics and exports 70% of its product to the EU, the USA and Australia.

Neither company reports significant environmental pressures on its exports. According to one of the companies, the major effect that environmental issues have had on its exports is the increased demand for niche "environmental fabrics" such as "natural look" unbleached textiles and all natural fibres. Environmental issues do not, however, seem to have affected demand for the traditional textiles which it supplies. The company said, for example:

We use loads of chlorine in our bleaching process but we've never had any problem with that from our local or international customers. They are really interested in price, quality and styling. The only ones who worry about our environmental side are the local authorities who set standards for our water effluent and so forth.

This is in stark contrast to the pulp industry where, as we have seen, chlorine has become a major issue. Neither company has experienced pressure to achieve environmental ac-

creditation and neither was aware of the possible introduction of eco-labels on any textiles that would affect its product range. However, one of the companies pointed out that its process involves very little chemical use and that this makes it much less vulnerable to international concerns.

One of the companies argued that the international textile industry is much more involved in a debate about human rights or social clauses in trade agreements than environmental ones. Some countries which have large textile industries have come under fire for their human rights records or for the use of child labour. Trade measures have been threatened against some of these countries and the social clause issue seems set to dominate the debate in the textile industry in the foreseeable future.

There is some danger, however, that local producers may have insufficient access to information about environmental requirements in export markets, especially in light of the current discussions on establishing a European eco-label for textiles. There are already draft criteria for a European eco-label on T-shirts and bedlinen. These criteria indicate the adoption of a life-cycle approach and, therefore, take account of the use of pesticides on the growing of cotton as well as elements of the textile production process such as energy and water use, chemical use and noise (United Nations Conference on Trade and Development—UNCTAD 1995:27). There are also a number of privately issued textile eco-labels that are already in place, including labels in the Netherlands and Germany. Some of these labels relate to the process of production and others relate to the presence of substances in the product itself.

It is imperative that South African companies have access to proper information about these developments and that they are involved in discussions about the criteria for such schemes. If the companies and/or the industry federation fail to remain informed and involved in these discussions, there could be negative consequences for South African exports in the longer-term.

### **Timber**

Two companies were interviewed in this sector. Between them they export some 1,3 million tonnes of logs and wood chips mostly to the Japanese market. One of the companies also exports sawn timber products. Both companies have experienced some environmental enquiries from customers, including being asked to submit verification—and in one case independent accreditation—that the wood is all sourced from plantation rather than old-growth forests. Like in the pulp industry, this has been a source of advantage for South Africa since all forests are managed plantations. Companies which are unable to provide assurances about the source of their timber are apparently being forced out of certain markets, particularly in Europe.

One of the companies is exploring an accreditation system for its timber and timber products which involves applying for the right to use a privately issued eco-label which assures the customer that the product has been produced in an environmentally responsible manner. These labels are issued by environmental groups such as the World Wide Fund for Nature and Friends of the Earth. In order to win approval from these groupings—and attach their label to the product—certain environmental requirements must be met. These

labels are particular to the wood industry and are mostly aimed at tropical hardwoods since these are most important with regard to deforestation. Nevertheless, the labels would be available to South African exporters and are being explored.

However, environmental issues which are specific to forestry in South Africa—such as the water-supply and biodiversity issues mentioned above—have not come under international pressure. While there is now some attention being given to these issues locally, it seems that they are currently of limited relevance to the international debate. This may change, however, especially with the increasing market share of other plantation-based timber industries such as Brazil and Argentina (UNCTAD 1995:25).

## **Understanding the trends**

As we have seen, South African exporters have experienced international environmental pressures of different kinds. These pressures may be classified as follows:

- direct customer pressure;
- standards, accreditation and eco-labels;
- domestic regulations;
- multilateral environmental agreements;
- campaigns against particular products or substances; and
- multinational company policies.

### **■ *Direct customer pressure***

This already quite widespread and companies in many sectors are expecting this to grow. In various forms it has been evident in the following sectors:

- coal (sulphur content);
- chemicals (potential hazards);
- fruit (chemical residues);
- packaging (recycled content and weight);
- pulp and paper (chlorine bleaching);
- steel (overall environmental policy); and
- timber (wood sources).

In some cases, international customers' interests reflect domestic regulations—for example, packaging—or the requirements of a management standard. In other cases, however, queries reflect the environmental policies of the consumers themselves.

### **■ *Standards, accreditation and environmental labels***

These are also growing as a form of pressure on exporters. The majority of companies interviewed in this study were aware of the development of management standards such as the ISO 14001 standard and most expect to apply for accreditation. A number of companies had been involved in the discussions about the development of the standard. Companies in the following sectors are considering applying for the standard:

- aluminium;
- coal;
- chemicals;
- minerals processing;

- packaging;
- pulp and paper;
- steel;
- soaps and detergents; and
- timber.

Fewer companies were aware of eco-labels—as opposed to management standards—although it is clear that there is increasing discussion of these in the international debate. At present they are concentrated in sectors such as pulp and paper, textiles, footwear and timber, but they may well spread to other sectors (UNCTAD 1995). In some sectors such as textiles and pulp, eco-labels have the potential to affect upstream suppliers such as cotton or timber farmers and cooperation is, therefore, needed across the pipeline.<sup>7</sup>

It is imperative that South African companies and industry organisations involve themselves in these discussions and remain informed. There may also be a role for government and government-supported organisations to provide the necessary information to companies.

#### **■ *Domestic regulations***

The enforcement of domestic environmental regulations has affected companies in a number of sectors. In most cases exporters must provide documentation proving their adherence to these regulations. In the experience of the companies the regulations tend to relate to the following issues:

- potential hazards(chemicals and minerals processing);
- chemical residues (fruit); and
- packaging (range of sectors).

South African government departments have a key role to play in servicing exporters who are attempting to meet other countries' regulations. Exporters frequently require documentation from government departments and it is important that they are able to provide these competently and timeously.

#### **■ *Multinational environmental agreements***

The provisions of multinational environmental agreements have affected some sectors and have the potential to affect many others. So far, the chemical industry has been most affected—mostly by the provisions of the Basel Convention (trade in hazardous waste) and the Montreal Protocol (CFCs). The FCCC has the potential to affect a number of sectors including electricity generation, aluminium, chemicals, coal, minerals processing, paper and steel.

It is important that the government departments that negotiate South Africa's participation in these conventions are in touch with the needs of companies and other interested parties such as trade unions. It is also important that, in addition to the role played by government departments such as Foreign Affairs and Environmental Affairs, the Department of Trade and Industry also participates in such discussions.

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<sup>7</sup> For a full discussion of the developmental implications of eco-labels see UNCTAD 1995.

### ■ *Campaigns against the use of particular products or substances*

The pulp and paper industry is the clearest example of an international campaign targeting a particular product or process—in this case chlorine-bleached pulp. The chemical industry may face similar campaigns with the Greenpeace campaign against persistent chemicals including chlorine. This campaign has not mustered the strength of the pulp campaign but may do so in future. It is likely that publicly driven campaigns will continue to play a vital role in setting the international environmental agenda.

### ■ *Multinational company policies*

The soaps and detergents sector is an example of the power of multinational companies to spread their environmental policies worldwide. As we have seen, South African subsidiaries of companies in that sector have adopted the environmental policies of their mother companies in ways which may well ensure that they have better environmental policies than they would otherwise. Multinationals do, of course, impose limits on their subsidiaries and there is a substantial international literature on the restrictive developmental effects of multinationals. Restrictions include limits on potential exports since subsidiaries are restricted to limited geographical areas. This is an example, however, of a more positive outcome of multinationals' global reach.

## **The impact of international environmental pressures**

At the beginning of this chapter we noted that international environmental pressures may be a double-edged sword. On the one hand, they may constrain companies' ability to export and may act as a form of protection for more developed economies; on the other hand, they may serve as a source of pressure for companies to raise their levels of environmental performance. Having presented the evidence from the study, what conclusions can we draw about these two possibilities?

The discussion of the sectors has revealed a number of trends regarding the environmental pressures on South African exporters. The experience of most sectors is that environmental pressures are building up in export markets but that there are no experiences of actual trade restrictions or barriers to foreign markets. There are a number of examples of sectors which have had to adapt to meet the environmental requirements of the market and this is especially the case in the pulp and paper, packaging, fruit and, to a lesser extent, chemical sectors. A number of sectors expect to make major adjustments in the near future, especially the steel and chemical sectors.

In some sectors, companies have found that they have a competitive advantage as a result of international environmental concerns. This is the case in the coal, timber and pulp industries. In all of these industries the advantage is based more on natural endowments than on a conscious environmental policy. Nevertheless, South Africa's low-sulphur coal and plantation forests—which were established as a result of a lack of natural forests—give our exporters some advantages.

This evidence creates a clear impression that international environmental pressures are having a positive impact on the environmental performance of South African exporters. Although this pressure is difficult to quantify, all the companies interviewed listed

international pressures as an important influence on their environmental performance. In many cases it was seen as the key influence. It is clear that in sectors like pulp and paper, chemicals and fruit, international pressures have had a decisive influence. As we have seen above, these pressures are sometimes based on international agreements or on foreign regulations, but often they are based on the demands of the market.

It is important to note, however, that international pressures are almost always combined with local pressures, whether these are in the form of regulations or community and other initiatives. At present local environmental pressures in South Africa are relatively weak although environmental lobby groups are certainly growing in strength. Environmental regulatory authorities are generally weak and under-resourced and this makes it difficult for the government to monitor individual plants' compliance with environmental regulations. International pressures may, therefore, play an important complementary role in encouraging companies to raise their environmental performance.

We have seen, however, that international pressures largely relate to global issues such as ozone depletion, global warming, deforestation and chemical build-up in marine waterways. Local environmental issues such as waste management, particulate emissions and local water quality are generally not addressed by international measures.<sup>8</sup> It should also be remembered that international measures are often subject to the ups and downs of the market and to changes in international sentiment. They should, therefore, not be seen in any way as a substitute for proper national environmental policies.

It is also worth remembering that international environmental movements are largely publicly driven. The pressure that has built up in international markets is mostly due to strong public and political support for environmental causes. The role played by non-governmental environmental groupings has been important. Continued pressure from these groupings will continue to help shape the international agenda.

## **Management and policy implications**

The experience of exporters reflected in this study raises a number of important issues for environmental management and policy in South Africa. Some relate to the actions of specific firms or industrial sectors whereas others require action from government. Specific policy issues are discussed below.

### **Energy supply**

Many of the exports discussed above are energy intensive. This is particularly true of the aluminium and minerals-processing sectors as well as certain types of steel and paper. Other sectors related to the energy debates are electricity generation, chemicals and coal. As noted above, low electricity prices are a major source of comparative advantage for South African exporters, but also makes them vulnerable to international trade measures. If significant action were to be taken against energy-intensive exports because of the envi-

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<sup>8</sup> Eco-labels may be an exception. Current draft criteria on textile eco-labels, for example, give attention to local issues including factory conditions such as control of cotton dust.

ronmental impact of our electricity generation, exports from a number of sectors would be affected. Similarly, if energy prices were to rise considerably as a result of investments in environmental abatement technologies, the comparative advantage of a number of exports could be affected. Of course, the energy generation sector is not the only contributor to CO<sub>2</sub> and other greenhouse gas emissions. The chemical sector is also key and should be taken into consideration in the debate. But the management of the energy sector's environmental impact is key to the trade and environment debate. It is possible that trade pressures could be applied to South Africa if we do not comply with environmental targets. South Africa is particularly vulnerable in this regard because of our very high proportion of coal-fired generation and because of the low cost of electricity. The market may apply direct pressures to our energy intensive exports by fostering an image of South Africa as a dirty energy producer. It is also possible that trade measures may be applied in the longer-term if South Africa is unable to fulfil its obligations under the FCCC. While the convention does not involve any trade measures at present, it is conceivable that these may be introduced in future.

However, there does not seem to be major concern about this among the companies interviewed. Eskom is keeping a close watch on the issue but so far has not committed itself to major initiatives regarding greenhouse gas emissions. Similarly, the minerals processing companies do not believe that strong action will be taken. Companies in a number of other industries, such as aluminium, did not seem aware of the issue and have certainly not identified it as a strategic issue.

It may be that the companies are well in touch with international trends and with their markets and that the energy greenhouse gas issue is unlikely to become a threat to our exports. Given the magnitude of the danger, however, perhaps more attention needs to be given to this issue. There is a clear need for coordination between Eskom, the energy intensive exporters and government on this issue. There is also a need to ensure that South Africa's position is well-represented at international negotiations on trade and environment in general and at the FCCC in particular. It will be important to include a range of government departments in these discussions including Foreign Affairs, Mineral and Energy Affairs and Trade and Industry.

### **Investment**

A second major issue arising from the interviews is the importance of investments in environmental abatement technologies. In a number of sectors—notably pulp and paper—very large environmental investments have already been made and managers interviewed in the electricity, chemicals, minerals processing, steel and paper industries pointed to the need for further environmental investments. In some cases these investments have economic benefits as well as environmental ones, but in others the investments would be purely environmental. In some industries—notably electricity, steel and chemicals—the required investments would be very large and the companies have not yet committed themselves to spending the necessary resources.

The problem is especially severe in old plants and in industries where the capital stock is generally old. The costs of reinvesting are already high and the need for environmental investments adds to the cost.

A failure to make the appropriate investments in clean technology may constrain the ability of companies to export in the long-term—to say nothing of the environmental consequences. A number of environmental managers interviewed for this study expressed frustration with senior management who they perceived as unwilling to make investments for purely environmental reasons. In certain sectors, however, such investments clearly are being made. In many cases major environmental investments are driven by the requirements of the international market rather than by local pressures or regulations. It seems, however, that such investments are made only when international pressures are very strong and quite unambiguous.

The steel industry is a case where large investments have to be made in a number of plants if environmental performance is to be raised to international levels. It seems that although environmental issues are not posing a danger to exports at present, they may well in the future. There is no guarantee, however, that the companies concerned will make the investments in good time. In the context of relatively old capital stock in much of the industry, companies may also have real difficulty in committing the required funds over the next few years. There may, therefore, be a role for government in helping to finance such investments where necessary. One possibility would be to make finance available through an institution such as the Industrial Development Corporation, or possibly through taking advantage of concessionary global finance for the environment. Government and private sector organisations also need to explore the possibility of getting finance through the Global Environmental Facility<sup>9</sup> and other finance schemes specific to the environment.

### **Access to information**

A third area arising from the interviews is the importance of information on environmental trends. Information on issues such as the FCCC and the potential development of eco-labels on particular products should be easily available to exporters. In this study we have seen a number of cases where companies seem unaware of initiatives that could affect their ability to export in the long-term. This includes textile companies which are unaware of the possible development of an eco-label on textiles and energy intensive companies which seemed unaware of the potential affects of global action against CO<sub>2</sub> emissions. There is a clear role for government here—as well as for private sector organisations such as the Industrial Environmental Forum—to provide information to companies. UNCTAD could also play a useful role in this regard. However, attempts to ensure proper access to information are only likely to succeed if there is proper coordination between various government departments and between government, the private sector and non-governmental organisations.

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<sup>9</sup> The Global Environmental Facility funds abatement of global environmental externalities.

In addition to the three priorities outlined above, there are a number of other policy issues arising from this study, namely:

#### ■ International management standards

One of the strongest trends to emerge in the interviews was the intention of a wide range of companies to apply for accreditation under the ISO 14000 environmental series. The ISO 9000 series of standards already have a strong following in South Africa and ISO 14000 is likely to become well-established among South African producers. A standard like ISO could play an important role in complementing regulatory work and in supporting national environmental and economic objectives.

ISO 14001 measures conformity to an environmental management system rather than the actual environmental performance of an organisation or its products.

The standard requires an organisation to identify its environmental policy and objectives and then build a system to ensure that it is able to meet those objectives. However, companies must meet certain minimum standards such as identifying and meeting its legal obligations, providing appropriate training for employees, maintaining proper environmental information systems and creating a procedure to deal with environmental emergencies.

Given this model, it is clear that the standard establishes a process for environmental management rather than measuring actual environmental performance. Accordingly, the ISO states:

It should be noted that this standard does not establish absolute requirements for environmental performance beyond commitment, in the policy, to compliance with applicable legislation and regulations, and to continual improvement. Thus, two organisations carrying out similar activities but having different environmental performance may both comply with its requirements ... [A]doption of this specification will not in itself guarantee optimal environmental outcomes (ISO 1995:5).

The ISO 14001 standard could be very useful, however, in ensuring that companies have environmental policies and action plans in place. The standard may also ensure that companies are more aware of and responsive to their legal obligations. This may help with the problem of enforcing regulations described above. This may provide more of an incentive to abide by environmental laws than the current system which relies on under-resourced government departments wielding very small sticks. While management standards cannot and should not substitute proper monitoring of the law, they may play a useful complementary role given our current regulatory weaknesses. Care should be taken, however, not to use market-based instruments such as ISO 14000 as an excuse to avoid beefing up our regulatory systems.

#### ■ Institutions

There may be certain institutional arrangements within the private sector and between the private sector, government and other organisations that foster more successful approaches to international environmental pressures.

The first of these is a set of institutions within sectors which provide environmental information, services and research for companies in the sector as a whole. The citrus fruit sector is a good example of how a central organisation can assist individual producers by gathering information on environmental requirements in export markets and conducting research to assist producers in meeting these requirements. Similarly, companies in the steel sector have established an industry environmental committee to cooperate on developing an environmental strategy for the sector as a whole. There may be economies of scale which make it easier to gather information or conduct research jointly. In this way, positive elements of competition can be introduced into an otherwise competitive environment.

It may also be helpful to establish some joint structures between government and business on issues such as the FCCC. Joint committees may also be useful in looking at issues like investment in environmental abatement technologies or in establishing a set of environmental targets for a sector as a whole. Such structures may also facilitate improvements in the services offered by government departments by providing clear information to government on the kind of assistance required by exporters.

#### ■ **Small, medium and micro-sized exporters**

The sample for this study did not include any small, medium or micro-sized companies and it is, therefore, impossible to comment in detail on the issues that may face such companies. However, it is clear from the experience of the large companies and from international literature (UNCTAD 1995) that successful management of international environmental pressures requires skills, information, systems and resources. It is reasonable to assume that all of these are in shorter supply in small firms than they are in large ones. There may be a special role, therefore, for government or for sectoral organisations to assist small and medium-sized exporters to manage their environmental performance.<sup>10</sup>

#### ■ **Government-level negotiations**

We have seen that the South African exporters interviewed for this study have not yet been subject to formal trade restrictions. South Africa has also not been involved in any environment-related trade dispute with other countries. However, given the potential that exists for environment-related trade disputes, it is likely that South Africa will be involved in such disputes in future. The international rules of the trade and environment game are currently being debated in World Trade Organisation committees, UNCTAD seminars and academic articles. It is imperative that South Africa is active in this debate and that government participates in negotiations over trade measures. This will require an acute understanding of the debates as well as a strong link with business and other interested parties such as trade unions.

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<sup>10</sup> For a full discussion of the environmental issues facing small, medium and micro-sized enterprises, see Coleman in this volume.

## Conclusion

This study was based on a small but significant sample of exporters. The experience of the companies shows that while exporters are not facing environment-related trade restrictions, they are more and more affected by international environmental pressures. These pressures are largely market-based. Companies are increasingly having to show that their products are produced in an environmentally responsible way and that their use will not cause environmental damage in their final destination. Some companies are also affected by environmental regulations in other countries and by international environmental agreements.

In most sectors, companies have been able to meet the new environmental requirements and expect to continue to do so. In other sectors, however, compliance will be more difficult and will require very substantial investments. The study also demonstrates that many companies are raising their environmental performance in response to international pressures and that this is helping to raise environmental standards in South Africa. The road ahead, however, is long and will require significant adjustments from companies. Government will also have to play a strong role in negotiating the conditions under which environment-based trade measures may be applied. Much will be required in the way of investment, information and skills if the potential benefits of environmental pressures can be realised while the dangers of protectionism are avoided.

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## chapter 4

# GREEN TRADE RESTRICTIONS?

## Some macroeconomic and environmental consequences

Bill Gibson and Dirk Ernst van Seventer

### Introduction

Green or environmental-based trade restrictions are, in principle, imposed by importing countries to deprive an exporting country of any competitive advantage based on environmental destruction.<sup>1</sup> In practice, green trade restrictions effectively amount to non-tariff barriers to trade which have the effect of limiting access to foreign markets by countries in which the gap between marginal private and marginal social costs has a significant bearing on international competitiveness. Some, but by no means all, green trade restrictions are GATT-compatible. In particular, those which seek to limit access based purely on process and production method externalities are inadmissible under GATT rules (Deloitte & Touche 1994: 23). While green trade restrictions have not yet had a significant impact on trade flows, they may be present in many forms such as eco-labelling, deposit refunds, environmental taxes and others.

Little is known about the precise relationship between growth, distribution and the environment, except that it is exceedingly complex and necessitates a structural analysis (Pezzey 1992, Karshenas 1993 and Taylor 1996). Few general analytical results are available, but it seems clear that, firstly, macro and environmental impacts cannot be separately analysed since growth and environmental deterioration often go hand in hand and, secondly, if green trade restrictions retard export growth and, therefore, GDP per capita, environmental degradation may follow. Gibson (1996) distinguishes extensive from intensive environmental degradation. The former refers to damage associated with

<sup>1</sup> All views expressed in this chapter are those of the authors and not the Development Bank of Southern Africa (DBSA). The authors are grateful to Craig Mackenzie and André Roux for their valuable criticism. Lance Taylor and Stephen Gelb collaborated on an earlier version of the model. Projections in this paper were originally made in July 1995.

distributively neutral output growth, while the latter comes about as a result of deterioration in the distribution of income which leads to environmental "mining". Hence, green trade restrictions may inhibit extensive but advance intensive environmental decay.

This paper investigates numerically the relationship between green trade restrictions, macroeconomic performance and environmental quality in South Africa using a multisectoral, dynamic computable general equilibrium model with both real and financial sectors. Three simulations are considered which attempt to capture some of the complex interactions of growth and distribution with key environmental indicators. For each simulation, a quadratic extensive environmental loss function is evaluated that assigns given weights to the emissions of greenhouse gases and water contaminants. The first addresses the effects of responding to green trade restrictions by internalising the local and global externalities of the South African energy sector. A second examines the issue of restrictions on foreign imports of South African mining products, in particular coal. A final simulation assesses the effects of restrictions on non-primary or manufactured exports due to consumption externalities generated by the energy-intensive methods by which they are produced. It is seen that the first option is macroeconomically superior to simply bearing the brunt of the green trade restrictions assumed in their second and third simulations.

The paper is organised as follows: the first section summarises the approach with a discussion of the relevant features of the computable general equilibrium model, key parameter settings and the base run; the second section discusses the environmental block and provides some estimates of emission levels; the third section presents the simulation results both with respect to their macroeconomic and environmental impact; and the fourth section concludes.

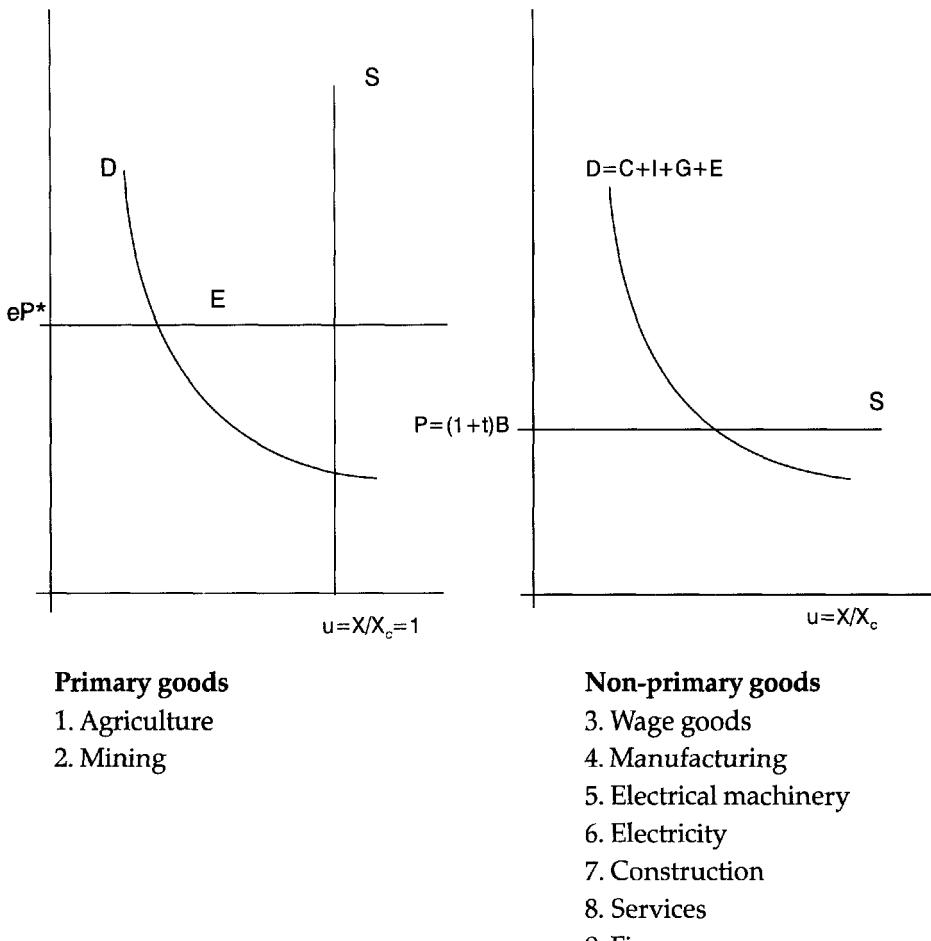
### **The model and the base run**

The model employed for the simulations is a nine-sector, two-class structuralist computable general equilibrium system with both real and financial sectors. See Gibson and Van Seventer (1996) for full details of the model specification. Its heritage is Keynesian in that an independent investment function is specified so that output adjusts to bring savings into balance with investment. The investment function depends upon an accelerator, the cost of capital and a "crowding in" term which captures the positive effect of public sector investment on private sector accumulation. For each period, aggregate demand determines the level of output. Across periods, however, supply-side factors are considered. Accumulated past investment determines the capital stock which, in turn, sets the level of capacity output according to productivity parameters. With capacity determined in the previous period, and output in the current period, the level of capacity utilisation is known.

Private consumption is determined by disposable income according to a linear expenditure system. Current government expenditure, including employment, rises with fixed growth rates over the 1994 levels while investment is a residual determined by an exogenous budget deficit to GDP ratio and an endogenous level of government savings. Exports are determined in two ways. As seen in Figure 1, primary exports, which include

agriculture and mining, are determined as a residual once output,  $X$ , and domestic demand,  $D_d$ , are known. Supply is set at full capacity utilisation,  $u$ , defined as the ratio of output to capacity output,  $X_c$ . The world price,  $P^*$ , converted at the endogenous exchange rate,  $e$ , is taken as an exogenous parameter.

**FIGURE 1** Market structure and sectors in the computable general equilibrium model



The market structure for non-primary goods is shown in the second panel of Figure 1. Demand,  $D$ , is determined as the sum of consumption,  $C$ , investment,  $I$ , including private and public and government expenditure,  $G$ ; plus net exports,  $E$ . The price in the non-primary markets is determined as a mark-up,  $t$ , on costs,  $B$ . Exports in the non-primary sector are tied to capacity growth in those sectors. There is some switching built into the model in that non-primary exports rise as a proportion of output with the real exchange rate.

Wages adjust to inflation incompletely with endogenous labour productivity that depends upon various measures of labour market tightness. Public sector wages match those of the private sector. The exchange and interest rates are managed by the South African Reserve Bank (SARB) and are described in the model with a reaction function based on capacity utilisation, inflation and the state of the reserves. Firms and households allocate their portfolios of wealth in proportion to relative rates of return on equity, bonds, capital flight and money. The government borrows from the central bank and foreigners and the rest of the debt is placed with the public investment commissioner and the domestic financial sector. The latter create loans to themselves sufficient to absorb the residual public sector debt. The money creation that results is, therefore, "indirect monetisation".

The base run is our best guess for the trajectory of the South African economy over the next five years. The assumptions underpinning the base run are that restrictive monetary and fiscal policy will continue to dominate with the ratio of the public sector borrowing requirement to GDP falling from its current level of about 6% to 4,5% by 1999, the end of the forecast period. The nominal wage and SARB reaction functions will continue to behave as they have in the recent past, and private investment recovers to allow for a 3,3% rate of growth in 1995. Good rainfall is assumed to boost capacity growth in agriculture and capital inflows will prevent a severe depreciation of the rand.

**TABLE 1** Macro-data for the base run

	Capacity utilisation	GDP growth	Real	Inflation GDP	Interest rate	Real wage <sup>1</sup>	Gini Coefficient
1994	83,8	2,3	266,8	10,4	12,8	104,0	0,4722
1995	86,7	3,3	275,5	8,7	14,1	105,6	0,4761
1996	88,2	3,6	285,5	9,5	15,2	105,3	0,4785
1997	88,7	3,2	294,7	9,4	15,2	105,5	0,4805
1998	88,5	3,1	303,7	8,7	14,1	106,3	0,4821
1999	88,5	3,5	314,3	8,4	13,7	106,9	0,4838
Period averages							
1990-94	82,6	0,0	263,1	12,5	15,1	102,3	0,4660
1995-99	88,1	3,3	294,7	8,9	14,5	105,9	0,4802

*Source: model calculations*

<sup>1</sup> 1990 = 100

Table 1 shows how the model behaves in the base run. The slight dip in GDP growth for 1997 is characteristic of the model in that it reflects the interaction of the multiplier and accelerator. A burst of investment causes capacity to rise and if growth in demand does not validate that capacity growth, investment will turn down again in the next period. Thus,

the model will not predict smooth growth unless both capacity and demand grow at precisely the same rate. Since there is no mechanism to bring this about, the model typically produces some mild fluctuations in output.

Observe that GDP growth averages 3,3% over the period while inflation decreases to below 10%. The latter is the result of trade liberalisation and strict monetary policy which combine to slow the rate of depreciation of the rand. In the fifth column it can be seen that the real interest rate has increased significantly compared to the 1990-94 period, the result of the aggressive posture of the SARB as modelled in their reaction function. Note further that nevertheless the second-last column shows a slight increase in the real wage as a result of declining inflation. In this model, as in reality, restrictive monetary and fiscal policies are consistent with higher real wages for the employed and slower job growth for the unemployed. Consequently, the distribution of household income worsens during the forecast period, as confirmed by a rise in the Gini coefficient in the last column. Skilled labour benefits from the modest growth, but the latter is far from sufficient to compensate unskilled labour with higher employment.

### The environmental block

In the simulations to follow, we track the output of a number of different environmental hazards. These are roughly grouped according to whether the externality is predominantly local or global. The electricity sector is a key contributor to South Africa's industrial emissions (Booth 1994: 227). South Africa's electrical power has been historically structured around coal-based stations burning low-quality bituminous coal. Given that electricity is an important input to many exports, particularly energy-intensive products, the global environmental externalities of the electricity sector may put a range of exports at risk from green trade restrictions. In order to evaluate the macroeconomic costs of green trade restrictions in an appropriate context it is necessary to examine the impact of reducing pollution generated by the electricity sector. The production externalities are clearly not limited to South African residents. The World Resources Institute places South Africa 17th on the list of its greenhouse index ranking (1991), contributing more than 1% of world greenhouse gas, while Eskom's *Annual Environmental Report 1995* claims that South Africa is the 12th largest producer of CO<sub>2</sub>. Its per capita ranking for CO<sub>2</sub> is much lower, however, at 42nd. (World Resources Institute 1995: 201).

On the basis of a survey of 12 sectors of the South African economy, Bethlehem in this volume suggests that international environmental concerns are building up. While there is as yet no evidence of actual trade restrictions or barriers to foreign markets, the expectation is that international pressures are likely to become an important factor. Columbus and Alusaf, two primary processing operations, are installing state-of-the-art pollution control technology, anticipating that they will be forced to meet international standards (*Finance Week*, August, 17-23, 1995: 6). Other, more local producers are following the lead (Deloitte & Touche 1994).

To quantify the interaction of macro and environmental variables, the database of the model is expanded to include emissions coefficients which are available for the year

**TABLE 2** Estimated total emissions for all production activities as well as unit abatement costs in the electricity sector

Type of emission	Symbol	Externality	Total emissions 1992 (tonnes x 10 <sup>6</sup> )	Abatement costs in electricity (1992 rand/tonne)
Suspended solids	SS	local	1,6	0,03
Total dissolved salts	TDS	local	3,8	0,71
Oxygen-demanding products	ODP	local	1,7	0,04
Particulate matter	Part.	local	0,9	10,00
Carbon monoxide	CO	local/global	55,0	2 000
Sulphur dioxide	SO <sub>2</sub>	local/global	2,2	1 624
Nitrogen dioxide	NO <sub>2</sub>	local/global	5,6	2 000
Carbon dioxide	CO <sub>2</sub>	global	883,8	1 000
Methane	CH <sub>4</sub>	global	2,4	2 000

Source: DBSA unpublished data and DBSA model calculations

1992. Table 2 shows harmful emissions identified in the model<sup>2</sup> with their respective total emissions<sup>3</sup> and unit abatement costs in the electricity sector<sup>4</sup> for 1992.

Suspended solids can be found in the waste product that remains after the screening and maceration of the sewage of domestic and industrial sources. As part of sewage sludge it would, in principle, be possible to undertake recycling were it not for the high concentration of harmful substances, such as heavy metals. Nevertheless, sewage sludge is increasingly being dumped. Suspended solids contained in sewage sludge that is used as fertiliser end up polluting vast tracks of agricultural land, gardens and parks (Booth

<sup>2</sup> Emissions not reported are hazardous waste, solid waste, nuclear waste and waste produced by households. Environmental emissions data is drawn from an unpublished DBSA database. This database is new and will need to be refined over time. Data parameters have, however, been confirmed by follow-up interviews.

<sup>3</sup> Total emissions are calculated by multiplying sectoral emission coefficients (per unit of gross value of production) from DBSA unpublished data with 1992 sectoral gross value of production from the DBSA model.

<sup>4</sup> No published information was available for CO<sub>2</sub> abatement costs in South Africa. Abatement costs for CO<sub>2</sub> in China (World Bank 1994) appears to be around R200 per tonne. For our purposes it was decided to take the average of the abatement costs of CO<sub>2</sub> in China and as reported in the DBSA unpublished data.

1994: 233). Suspended solids can be removed by means of sedimentation, flocculation and rapid sand filtration.

Reducing the emission of suspended solids would reduce the quantity of contaminated sludge that must be absorbed into the environment thereby benefiting South Africans. Suspended solids are, therefore, exclusively local process and production method externalities and, under current standards and practice, should not induce green trade restrictions. But since the energy sector is responsible for a significant amount of sludge contamination, suspended solids are included in our list of negative local externalities.

Total dissolved salts contamination is the result of return flows polluted by industrialisation, urbanisation, irrigation and use of artificial pesticides and fertilisers in agriculture (Booth 1994: 239). The problem is worst in the arid and semi-arid regions of South Africa with its Karoo shales that are particularly vulnerable to groundwater seepage. A total dissolved salts concentration of more than 1 000 mg per litre is regarded as a health risk (President's Council 1991: 41). However, lesser concentrations could still be detrimental to health if large doses of minerals such as sodium, chloride or magnesium are present. Crop yields may also decline as a result of high salinity (Booth 1994: 244). Apart from the unpleasant taste, high concentrations of sulphates can lead to gastro-intestinal and other long-term complications. Desalination using membrane technologies can be used to reduce total dissolved salts, but the costs are high.

Oxygen-demanding products and industrial and municipal wastewater (including township wastewater) also constitute a serious environmental problem. Aquatic life is severely restricted by organic waste which contains oxygen-demanding products since the growth of decomposer populations is accelerated. Emissions of oxygen-demanding products must be controlled with biofilters, trickle filters, oxygen dosing and maturation, that is, the biodegradation of waste that takes place naturally. Particulate matter—the result of solid fuel combustion and emission of industrial processes—is a highly visible type of air pollution and can lead to respiratory disease. Burning low-grade coal in township stoves also contributes to particulate contamination. This is, in part, the product of the lack of other energy options, but the use of coal stoves has also remained resistant to government efforts to promote the use of electricity for heating (Eberhard and van Horen 1995: 166). The industrial areas on the Mpumalanga highveld, with its coal-fired electricity power stations, are main industrial contributors. Total dissolved salts, oxygen-demanding products and particulate matter are, clearly, local externalities.

There are a number of externalities which could trigger green trade restrictions due to their combined local and global character. Carbon monoxide is an example. Although CO is poisonous its dispersal range is very limited and its major environmental significance is linked to the breakdown of hydroxyl, an atmospheric cleansing agent which is believed to contribute to the geographic spread of acid rain. Similarly,  $\text{SO}_2$  and  $\text{NO}_2$  contribute to acid rain. The Mpumalanga power stations are a main source of this type of pollution. Sulphur dioxide causes irritations of the respiratory passages and vulnerability to infections, and exacerbates asthma, emphysema and bronchitis. Acid rain reduces the biological productivity of waterways and dams as well as soil, affecting yields in timber and agriculture (Booth 1994: 230). Dry and wet scrubbers are used to trap acid-forming pollutants, such as  $\text{SO}_2$ .

The emissions most likely to trigger green trade restrictions are CO<sub>2</sub> and CH<sub>4</sub>. These greenhouse gases lead to an increase in tropospheric temperatures which may result in global climate changes. There is a range of greenhouse gases, but it is widely accepted that CO<sub>2</sub>, especially from fossil fuels, and CH<sub>4</sub> are major causes of concern. Not only industrialisation should be blamed; deforestation for household fuel has also played an important part in upsetting the global carbon balance. Methane emissions, caused by feedlots, rubbish dumps and coalmining activities, also contribute to creating a global thermal blanket.

Since it is extremely difficult to know how to weigh these various measures of environmental quality, we assume that each pollutant will be equally harmful. This option gives equal priority to the clean-up of local and global emissions. The obvious disadvantage of this strategy is that green trade restrictions are more likely to be imposed due to global rather than local environmental damage. From a domestic perspective, however, it would be somewhat unreasonable to select environmental policy strictly on the basis of its global impact. In what follows, we examine the local/global mix of environmental improvement in each simulation as a rough measure of the distribution of environmental benefits.

In the computable general equilibrium model, we use a quadratic extensive damage function which sums with equal weights all damage due to emissions. This function rises with output and decreases as firms clean up. Abatement costs for the electricity sector are shown in the last column of Table 2. These costs are assumed to be linear functions of output, simplifying the more likely underlying non-linear relationship. Table 3 provides some information on the pattern of emissions associated with the growth path of the base run. Significant environmental deterioration is clearly observable in the table, with all contaminants seen to rise in absolute value over the forecast period.

**TABLE 3** Emissions by type for the base run (tonnes x 10<sup>-6</sup>)

	SS	TDS	ODP	Part.	CO	CO <sub>2</sub>	CH <sub>4</sub>	SO <sub>4</sub>	NO <sub>2</sub>
1994	1,71	4,55	1,90	0,89	56,48	926,12	2,51	2,40	5,83
1995	1,75	4,56	1,96	0,91	58,64	956,69	2,50	2,42	6,02
1996	1,82	4,87	2,04	0,95	60,92	993,87	2,59	2,49	6,25
1997	1,89	4,99	2,13	0,98	63,11	1 029,50	2,63	2,57	6,48
1998	1,95	5,14	2,20	1,01	65,19	1 063,55	2,68	2,64	6,69
1999	2,02	5,32	2,29	1,05	67,61	1 103,18	2,74	2,72	6,94
Period Averages									
1995-99	1,88	4,97	2,12	0,98	63,09	1 029,36	2,63	2,57	6,48

*Source: model calculations*

Note, finally, that the information of Tables 2 allows us to measure the change in extensive damage only. No attempt is made to estimate the additional decay which would be provoked by deterioration in the distribution of income. Clearly, if a given policy package registers the same value of the extensive damage function, but implies a deterioration in the distribution of income, there will be some collateral intensive damage. If properly measured, intensive environmental decay in South Africa would unquestionably increase the emissions of oxygen-demanding products and particulate matter through, for example, increased informal settlements with inadequate sanitation and energy services. It is less clear that emissions of suspended solids would increase, although it is likely. These intensive contaminants are strictly local and would affect local air and water quality. It is difficult to conceive of intensive decay contributing to significant global environmental risks in South Africa, such as CO<sub>2</sub> emissions, since it would most likely be the result of deforestation, which has largely already taken place. As noted, the principal cooking and heating fuel is coal rather than wood. There could conceivably be some small increase in the emissions of CH<sub>4</sub> due to intensive deterioration, but it is difficult to know how important this effect would be.

## Simulations

Green trade restrictions will affect the economy by restricting export markets for both traditional and non-traditional exports, and the result will be a contraction in output and employment. To pre-empt the green trade restrictions, South Africa could clean up its coal-fired energy sector, which is an important input into both classes of exports. In the first of the simulations to follow, we ask what the impact on the macroeconomy would be if emissions by the electricity sector were significantly reduced.<sup>4</sup> Clean-up costs, both foreign and domestic, will be seen to have a contractionary effect on output, due in part to the tightening of credit by the SARB as a reaction to the cost-push inflation. The benefit, of course, is a cleaner environment and the assumption is that the effort is sufficient to avoid restrictions on South African exports.

In two subsequent simulations, we quantify the costs of the alternative strategy, which is to say, avoiding the clean-up and then suffering from green trade restrictions. The first assumes that the green trade restrictions will be aimed exclusively at primary exports. In the last simulation, the green trade restrictions are imposed on non-traditional exports. As noted above, environmental decay as measured by an extensive damage function, declines with the clean-up of the energy sector. Green trade restrictions also reduce the value of the extensive environmental damage function. To compare the macroeconomic effects, we set the value of the damage function in the second and third simulations equal

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<sup>4</sup> It should be noted, however, that the nature of the international requirements to reduce emissions is not known. We, therefore, model a hypothetical example based on a reduction of various emissions, including greenhouse gases. We acknowledge that some of the adjustments made in the model (such as a reduction in CO<sub>2</sub>) are not easy to implement in the real world.

to its value in the first. We then backsolve for the level of green trade restrictions on traditional and non-traditional exports consistent with the level of environmental damage in the first simulation. In other words, given a target level of environmental quality, is it better to clean up or simply restrict traditional and non-traditional exports to meet the same target?

### Cleaner electricity

The first experiment reduces all emissions per unit of output generated by the electricity sector by 35%, phased in an accelerated way over the five-year forecasting period. Given the abatement costs of Table 1, this will lead to higher energy costs and, with a fixed mark-up, higher prices. These higher costs are reflected in higher intermediate demand by the electricity sector for goods supplied by the manufacturing sector and imported goods due to higher maintenance of existing equipment. Similarly, new clean-up equipment purchases shift up investment demand by the electricity sector. It is further assumed that the composition of new investment goods reflects a higher proportion of imported versus locally supplied investment goods, as firms install state-of-the-art scrubbers, monitoring devices and other equipment not locally available.

Of course, if the mark-up rate in the energy sector remains constant, firm income increases with costs for the same level of output. Since the elasticity of demand for electricity is low, the mark-up was exogenously reduced by 7.5%, phased in over the period, to force this sector to internalise rather than pass through some of the costs of abatement. As a result, firm income in the electricity sector is more or less the same as in the base run. As a consequence, the price of electricity will still rise by more than 7% compared to the base run by the end of the period. Note that this conflicts with Eskom's intention to lower the price of electricity to the municipal retailers (Eberhard and van Horen 1995). The macroeconomic impact of this experiment is evaluated in Table 4.

It can be seen in Table 4 that internalising environmental costs by the electricity sector is expected to have a slight contractionary impact on the South African economy. Gross domestic product is almost 2% lower compared to the base run at the end of the period. As just noted, rising costs are only partially passed on, and in the third column it can be seen that inflation is slightly higher than in the base run (0.1% on average). In spite of the slowdown in the economy, the reaction by the SARB is to tighten credit. Together with the drop in capacity utilisation, this will lead to lower investment.

In the fifth column it can be seen that public investment decreases slightly. As explained previously, government investment is assumed to be the residual of the public accounts. With constant growth rates assumed for government current expenditure and a contracting economy, the budget deficit will decline to respect the public sector borrowing requirement to income constraint. Consequently, less is available for government investment. In addition, tax revenues decline with the slowdown in economic activity, although this is to some degree counterbalanced by bracket creep due to the additional inflation.

The impact on the overall—that is, primary plus non-primary—export performance is approximately neutral. As a result of the export-clearing nature of the primary sectors

**TABLE 4** Macro-data with cleaner electricity (ratios to base run)

Year	GDP	Inflation Rate <sup>1</sup>	Interest Rate <sup>1</sup>	Private Invest	Public Invest	Exports			Foreign Savings
						Total	Primary	Non-prmy	
1994	100,0	0,0	0,0	100,0	100,0	100,0	100,0	100,0	100,0
1995	99,9	0,0	0,0	99,7	98,6	100,0	100,0	100,0	99,8
1996	99,7	0,0	0,0	99,0	96,5	100,1	100,1	100,0	97,3
1997	99,2	0,1	0,1	97,7	92,8	100,1	100,3	99,9	93,3
1998	98,7	0,1	0,1	96,3	89,3	100,0	100,3	99,6	91,5
1999	98,0	0,1	0,1	94,8	86,1	99,8	100,2	99,2	90,4
Period averages									
1995-99	99,1	0,0	0,1	97,5	92,7	100,0	100,2	99,7	94,5

*Source: model computations*

<sup>1</sup> Absolute differences from the base run (in percentage points).

and a slight contractionary impact on the macroeconomy, exports of the primary sector will increase as seen in Figure 1 and confirmed by Table 4. With a contraction in economic activity, agriculture and mining can export more. Exports of the non-traditional sectors, on the other hand, are linked to capacity and will, therefore, drop with GDP which, from data not shown, slows more rapidly than in traditional sectors. One of the reasons is that heavy manufacturing is more electricity-intensive than mining when backward linkages of the input-output submatrix of the model database are taken into account. A policy to penalise electricity intensive production activities will have a more negative impact on non-traditional sectors than on traditional sectors. Finally, it can be seen that imports contract so that foreign savings decline while exports remain roughly constant.

The impact on employment is shown in Table 5. It can be seen that employment in the primary sector is better protected during the contraction due to the export clearing nature of these sectors. Non-primary sectors show more of a decline, also due to their energy intensity, as discussed above. Higher inflation leads to a drop in real wages. Both skill categories appear to suffer a similar decline.

Note that virtually all the environmental improvement can be classified as extensive rather than intensive, due to the very small change in the distribution of income. The last column of Table 5 suggests only a microscopic improvement in the overall distribution of household income. The reason is that the economic contraction causes income from profits to fall and its distribution favours high-income households. The decline in the extensive damage function is probably a fairly accurate measure of the decline in the rate of

**TABLE 5** Employment and wages with cleaner electricity (ratios to base run)

Year	Employment					Real wages			Gini Coeff <sup>1</sup>	
	Total	Primary		Non-primary		Total	Unskilled	Skilled		
		Unskilled	Skilled	Unskilled	Skilled					
1994	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	0,0000	
1995	99,9	100,0	100,0	99,9	99,9	100,0	100,0	100,0	-0,0001	
1996	99,8	100,0	100,0	99,7	99,7	100,0	100,0	100,0	0,0000	
1997	99,3	99,9	99,9	99,2	99,3	99,9	99,9	99,9	-0,0002	
1998	98,7	99,7	99,7	98,5	98,7	99,8	99,8	99,8	-0,0002	
1999	98,0	99,3	99,4	97,7	98,0	99,6	99,6	99,6	-0,0003	
Period averages										
1995-99	99,2	99,8	99,8	99	99,1	99,8	99,9	99,8	-0,0002	

*Source: model computations*

1 Absolute differences from the base run.

environmental deterioration. The details of the change in the environmental measures are shown in the next two tables.

Table 6 reveals that the contraction brings about a significant decline in levels of liquid emissions. Significant reduction in gaseous emission is shown in Table 7. Both toxic as well as greenhouse gases are about 10% lower at the end of the period compared to the base run. The main contribution to the lower emissions are made by SO<sub>2</sub>, NO<sub>2</sub> and CO<sub>2</sub>. Harmful particulates and CO report less substantial reductions, whereas the reduction in CH<sub>4</sub> is negligible.

We conclude that while environmental clean-up will trade off with output and employment, the results of this computable general equilibrium study suggest that the cost is not excessively high. For average loss of about 1% of GDP, locally harmful emissions can be reduced by an average of 6% and greenhouse gasses by 4%, where the implied elasticities refer to extensive deterioration. Moreover, the composition of the improvement favours domestic versus global residents. The latter benefit, of course, but the close link between domestic costs and domestic benefit would unquestionably enhance the political feasibility of the policy.

**TABLE 6** Liquid contaminants with cleaner electricity (ratios to base run)

Year	Average	SS	TDS	ODP
1994	100,0	100,0	100,0	100,0
1995	98,9	97,5	99,9	97,7
1996	97,5	94,3	99,8	94,8
1997	95,7	90,3	99,6	91,2
1998	93,5	85,8	99,2	87,2
1999	91,1	80,8	98,7	82,6
Period averages				
1995-99	95,3	89,8	99,4	90,7
Average growth rate				
1995-99	1,5	-0,8	2,9	-0,0

*Source: model calculations*

### Green trade restrictions on traditional exports

Mining is the sector most vulnerable to trade restrictions based on environmental destruction, at least on a process and production method basis. Coal is also a major export commodity for South Africa and might incur green trade restrictions on the basis of consumption externalities. Direct regulation of mining to meet an environmental goal will be costly to the economy in foregone output, employment and foreign exchange earnings. As noted above, to measure the effects of green trade restrictions on the macro-performance of the economy, we reduce the output of mining to the point that the value of the damage function is the same as in the first experiment. The impact on the export sector of the South African economy is shown in Table 8, measured in terms of deviations from the base run.

Primary exports fall substantially, dropping to only 90,3% of its base run value by 1999. Surprisingly, non-traditional exports are also lower. As will be seen in the next table, the decline is attributable to lower economic activity and, through the accelerator, lower capacity growth. Since non-traditional exports are linked to capacity output, slower growth translates into lower non-traditional exports. The combined result is that total exports are about 7,5% lower compared to the base run at the end of the period. In the last column it can be seen that after the second year imports decline more rapidly. As a result, foreign savings are lower compared to the base run at the end of the period.

**TABLE 7** Gaseous emissions with cleaner electricity (ratios to base run)

Year	Locally harmful emissions				Greenhouse gases			
	Total	Partic	SO <sub>2</sub>	NO <sub>2</sub>	Total	CO	CO <sub>2</sub>	CH <sub>4</sub>
1994	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
1995	98,5	99,1	97,2	99,0	99,1	99,9	99,1	100,0
1996	96,7	97,9	93,6	97,7	98,0	99,7	97,9	99,9
1997	94,3	96,4	89,2	96,0	96,4	99,3	96,2	99,8
1998	91,5	94,5	84,2	94,0	94,6	98,8	94,3	99,5
1999	88,4	92,4	78,5	91,7	92,5	98,1	92,1	99,1
Period averages								
1995-99	93,9	96,1	88,5	95,7	96,1	99,2	95,9	99,6
Average growth rate								
1995-99	1,8	-2,3	1,8	2,0	3,3	1,9	1,6	1,2

*Source: model calculations*

A decline in output of the primary goods sector sufficient to improve the environment to the level of the first simulation would be clearly harmful to the economy. As seen in the Table 8, GDP falls to 92,4% of the base run versus 98,1% in the first simulation. On average GDP falls by 4% rather than 0,9% with the electricity clean-up. With lower output, inflation also falls since the cost push is absent here and labour market pressures are reduced. Note further the dramatic drop in the rate of investment. This is in part a response to the decline in the level of activity, acting through the accelerator. The fall in investment would be worse were it not for lower interest rates.

The decline in economic activity has a dramatic impact on public finance. Public investment, which adjusts to the given public sector borrowing requirement to GDP ratio, falls to only 30,6% of the base run. One reason is the loss in mining output which causes a precipitous decline in tax revenues along similar lines discussed by Makgetla (1995). Lower inflation also reduces the indirect tax take. Furthermore, with constant government expenditure in real terms—despite lower real wages for government employees—there is less left over for public sector investment. The drop in GDP aggravates the decline since the public sector borrowing requirement must maintain the constant ratio to GDP. Moreover, since government investment crowds in private investment in the model, the latter collapses.

**TABLE 8** Green trade restrictions on traditional exports (ratios to base run)

Year	GDP	Inflation Rate <sup>1</sup>	Interest Rate <sup>1</sup>	Private Invest	Public Invest	Exports			Foreign Savings
						Total	Primary	Non-prmy	
1994	100,0	0,0	0,0	100,0	100,0	100,0	100,0	100,0	100,0
1995	99,0	-1,1	-1,5	95,8	83,2	98,3	97,3	100,0	105,9
1996	97,8	-1,7	-2,5	91,5	70,2	97,0	95,4	99,5	106,8
1997	96,2	-2,3	-3,4	86,0	54,9	95,4	93,2	98,6	95,8
1998	94,4	-2,6	-3,8	80,5	41,4	93,9	91,5	97,2	86,8
1999	92,4	-2,6	-3,8	75,4	30,6	92,4	90,3	95,3	78,4
Period averages									
1995-99	96,0	-2,1	-3,0	85,9	56,1	95,4	93,5	98,1	94,7

*Source: model computations*

<sup>1</sup> Absolute differences from the base run (in percentage points).

Table 9 shows that the blow to the mining sector causes economy-wide employment levels to suffer. Primary employment is hit worse than non-primary, but only marginally. Both skilled and unskilled labour share the pain of rising unemployment but, for those who keep their jobs, lower inflation results in a small increase in real wages. The real wages of skilled labour are more sensitive to excess capacity and, therefore, fall faster. The final column of the table shows a decline in the Gini coefficient which suggests that income is more equally distributed, albeit with a smaller pie. Thus, any intensive gains will add to the extensive improvement made here.

The general conclusion of Table 9 is that green trade restrictions on the primary sector must be avoided. To achieve a significant improvement in environmental quality by direct restrictions on mining exports would be very costly to South Africa. While the impact of green trade restrictions on primary exports would be far more contractionary than the electricity clean-up studied above, it remains to be seen whether some significant gains in local environmental quality would accompany the restrictions.<sup>6</sup>

Table 10 suggests that cutting back on mining production will not reduce total liquid contaminants production as much as in the electricity experiment. Although the production of total dissolved salts is lower, suspended solids and oxygen-demanding products are higher, affecting local water quality. Thus, on the one hand, emissions of total dissolved

<sup>6</sup> As noted, the overall impact is the same as in the first simulation.

**TABLE 9 Employment and wages with green trade restrictions on traditional exports  
(ratios to base run)**

	Employment				Real wages				
	Primary		Non-primary		Skilled	Total	Unskilled	Skilled	Gini Coeff
Year	Total	Unskilled	Skilled	Unskilled	Skilled	Total	Unskilled	Skilled	Gini Coeff
1994	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	0,0000
1995	98,8	97,9	97,4	98,7	99,0	100,9	100,9	100,9	-0,0004
1996	97,3	96,2	95,3	97,1	97,6	101,6	101,8	101,5	0,0008
1997	95,3	94,2	92,9	94,9	95,7	102,4	102,9	102,1	-0,0015
1998	93,1	92,5	91,0	92,4	93,5	103,0	104,0	102,4	-0,0021
1999	90,7	91,0	89,4	89,7	91,2	103,3	105,0	102,5	-0,0029
Period averages									
1995-99	95,0	94,4	93,2	94,6	95,4	102,2	102,9	101,9	-0,0015

*Source: model computations*

<sup>1</sup>Absolute differences from the base run.

salts are much higher in mining than in electricity; on the other hand, the emissions of suspended solids and oxygen-demanding products are higher for electricity.<sup>7</sup>

Table 11 shows that restricting mining output fails to improve toxic gas emissions as much as with the clean-up of the electricity sector. Greenhouse effects are about the same. The emission of particulates, NO<sub>2</sub> and CO, are reduced to a larger degree compared to the first simulation. However, emissions of SO<sub>2</sub> and CO<sub>2</sub> are not reduced as much. On the other hand, primary sectors are major producers of CH<sub>4</sub>, as is seen in the table. Given equal weights in the damage function, this results in the same reduction of overall environmental damage, with the ratio of benefits slightly more in favour of global versus local residents. The more rapid improvement in the Gini coefficient suggests that extensive and intensive environmental decay do not trade off in South Africa, but rather work in the same direction. Some minor improvement could then be expected in intensive deterioration.

These caveats aside, we conclude that green trade restrictions show no significant special advantages over the cleaner energy option with respect to the environment. While overall contamination remains constant by assumption, the benefit from the change in composition hardly seems worth the increased sacrifice required to achieve green trade.

<sup>7</sup> This suggests that first-round or direct effects are dominating the final outcome with indirect emission effects playing a secondary role.

**TABLE 10** Liquid contaminants with green trade restrictions on traditional exports  
(ratios to base run)

Year	Total	SS	TDS	ODP
1994	100,0	100,0	100,0	100,0
1995	99,0	98,8	99,2	98,9
1996	98,0	97,4	98,4	97,6
1997	96,5	95,5	97,2	95,8
1998	94,8	93,4	95,8	93,7
1999	92,9	91,2	94,2	91,4
Period averages				
1995-99	96,2	95,3	96,9	95,5
Average growth rate				
1995-99	1,9	1,6	1,9	2,0

*Source: model calculations*

### **Green trade restrictions on non-traditional exports**

As a non-tariff barrier, green trade restrictions might well target manufactured goods rather than raw materials. Primary exports could escape restrictions, while the more competitive goods are excluded. The previous section clearly shows that if green trade restrictions are imposed on primary goods, the effect on the economy would be contractionary. In this section we measure the impact of green trade restrictions on manufactured or non-traditional exports.

An average reduction of 12% of non-traditional exports is necessary to achieve the target value of the environmental damage function, as seen in Table 12. Note that the effect on GDP is slightly less contractionary than for traditional exports. This is due to the small rise in primary exports observed in the second column of the table. With the general contraction of the economy, intermediate demand for primary goods falls. Since the primary sectors always operate at full capacity, the backward linkage from the non-primary to the primary sector leaves a higher fraction of output available for primary exports. In the previous simulation, the restriction on primary output was not offset by a higher level of output in the non-primary sector since the loss of purchasing power in the former reduced demand for the latter. Green trade restrictions on the primary sector spilled over to the non-primary sector. Here the effect of the green trade restrictions is entirely borne by non-traditional exports, and this is the reason why the impact is not as contractionary. The

**TABLE 11** Gaseous emissions with green trade restrictions on traditional exports  
(ratios to base run)

Year	Locally harmful emissions				Greenhouse gase			
	Total	Partic	SO <sub>2</sub>	NO <sub>2</sub>	Total	CO	CO <sub>2</sub>	CH <sub>4</sub>
1994	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
1995	98,9	98,6	98,5	99,1	99,1	99,1	99,1	98,1
1996	97,7	97,1	97,0	98,0	98,0	98,0	98,0	96,5
1997	95,9	95,1	95,2	96,4	96,4	96,5	96,4	94,6
1998	94,0	93,0	93,2	94,5	94,5	94,6	94,5	92,9
1999	92,0	90,8	91,3	92,5	92,5	92,6	92,5	91,4
Period averages								
1995-99	95,7	94,9	95,1	96,1	96,1	96,2	96,1	94,7
Average growth rate								
1995-99	1,6	1,4	0,7	1,9	2,0	2,1	2,0	-0,0

*Source: model calculations*

structural character of the economy, with strong forward linkage running from the primary to the non-primary sector, but no linkage in the opposite direction, is principally responsible for this result.

The data of Table 12 indicate that the macroeconomy responds in much the same way as seen in the prior simulation. Inflation slows, but not by as much and the same for interest rates. The accelerator insures that investment will not fall by as much in the less contractionary environment. The public sector accounts behave in the same way as above. Public investment contracts with loss of tax revenue, but the effect is not quite as severe.

Table 13 shows that the strength of the forward linkages in that employment falls in the non-primary sectors by about the same amount as with green trade restrictions on traditional exports. The primary sectors, agriculture and mining, are less affected as they mainly have a powerful, unidirectional impact on the rest of the economy.<sup>8</sup> As in the previous experiment, real wages rise. Again, unskilled workers benefit the most since their wages are more responsive to inflation and less to labour market conditions than skilled workers'. The last column of Table 13 shows that the income distribution has improved somewhat relative to the two previous simulations, further reducing the rate of intensive

<sup>8</sup> For additional computable general equilibrium evidence of the power of the mining sector on the South African economy, see Gibson and van Sevenster (1996a).

**TABLE 12** Green trade restrictions on non-traditional exports (ratios to base run)

Year	GDP	Inflation Rate <sup>1</sup>	Interest Rate <sup>1</sup>	Private Invest	Public Invest	Exports			Foreign Savings
						Total	Primary	Non-prmy	
1994	100,0	0,0	0,0	100,0	100,0	100,0	100,0	100,0	100,0
1995	99,3	-0,9	-1,3	96,9	86,3	98,5	100,5	95,3	106,0
1996	98,3	-1,6	-2,2	93,3	74,5	97,2	100,9	91,4	107,7
1997	96,9	-2,2	-3,2	88,4	60,2	95,6	101,2	87,5	98,2
1998	95,2	-2,6	-3,8	83,1	46,7	94,1	101,1	84,1	89,5
1999	93,2	-2,8	-4,1	77,7	35,1	92,6	100,3	82,0	80,8
Period averages									
1995-99	96,0	-2,0	-2,9	87,9	60,6	95,6	100,8	88,1	96,4

Source: model computations

<sup>1</sup> Absolute differences from the base run (in percentage points).

decay. This result is consistent with the rise in real wages for unskilled labour, which is not accompanied by a steep drop in unskilled employment.

Again we ask if the composition of environmental damage is significantly altered by the green trade restrictions on non-traditional versus traditional exports. Non-traditional sectors clearly produce more liquid contaminants than their traditional counterparts. As can be seen in Table 14, the production of suspended solids and total dissolved salts is higher than in scenario 2, although it is counterbalanced by slightly lower oxygen-demanding products.

Compared to mining, non-traditional sectors produce on average more toxic gaseous emission when their exports are reduced. The reduction in greenhouse gases, on the other hand, is slightly lower but the CO<sub>2</sub> level is exactly the same. Methane production is higher compared to the mining simulation. Both mining and agriculture are significant CH<sub>4</sub> producers, and when output is reduced, levels fall more dramatically.

Non-traditional exports are dirtier locally and cleaner globally than traditional exports and it is, therefore, clearly in the interests of South Africans that they should be cleaned up. Green trade restrictions on non-traditional exports will have less of an impact on the macroeconomy and will still reduce globally damaging emissions. Since they will inhibit competition in manufactured goods but not threaten the flow of raw materials, green trade restrictions are much more likely to be imposed on non-traditional exports (McKenzie and Foster 1995: 2). While green trade restrictions on non-traditional exports would clearly be less damaging than on traditional exports, the cost to South Africa is still high compared to the costs of cleaning up the energy sector.

**TABLE 13 Employment and wages with green trade restrictions on non-traditional exports (ratios to base run)**

Year	Employment					Real wages			Gini Coeff <sup>1</sup>	
	Total	Primary		Non-primary		Total	Unskilled	Skilled		
		Unskilled	Skilled	Unskilled	Skilled					
1994	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	0,0000	
1995	99,0	100,0	100,0	98,7	98,9	100,7	100,8	100,7	-0,0004	
1996	97,6	99,9	99,9	97,1	97,5	101,4	101,6	101,3	0,0008	
1997	95,8	99,5	99,6	94,8	95,6	102,2	102,8	101,9	-0,0016	
1998	93,6	98,7	98,8	92,2	93,4	102,9	103,9	102,4	-0,0023	
1999	91,2	97,4	97,6	89,5	91,0	103,3	105,0	102,6	-0,0030	
Period averages										
1995-99	95,4	99,1	99,2	94,5	95,3	102,1	102,8	101,8	-0,0016	

*Source: model computations*

<sup>1</sup> Absolute differences from the base run.

## Conclusions

This paper shows that the interaction of the macroeconomy and the environment is a complex and subtle process that is only barely within the grasp of analysts. We call it complex because the macro-environmental interface is wide-ranging, highly diverse and uncertain.

Aggregating a fraction of environmental effects in a damage function, as done here, is clearly limited in its ability to convey the nature of environmental problems confronting South Africa. While the weights of the damage function appear to be in need of adjustment, few guidelines are available; it is not even clear how to weight local versus global environmental threats. We call it subtle because conventional analytical approaches seem inadequate to the task of properly evaluating the trade-offs involved. The relevant model must blend short and long-run considerations appropriately. An exclusively short-run framework will over-emphasise the macroeconomic costs of environmental preservation, while the traditional neo-classical analysis of the long-run places undue emphasis on individual utility maximisation, usually in a sterile informational and institutional setting (Heal 1984). The model of this paper tries to strike a balance between the short-run, in which the environment is "held constant", and a long-run in which environmental destruction is fully anticipated and properly discounted.

**TABLE 14** Liquid contaminants with green trade restrictions on non-traditional exports  
(ratios to base run)

Year	Total	SS	TDS	ODP
1994	100,0	100,0	100,0	100,0
1995	99,4	99,0	99,8	98,9
1996	98,7	97,8	99,5	97,5
1997	95,7	96,1	98,8	95,7
1998	96,0	94,1	97,7	93,5
1999	94,1	91,9	96,2	91,2
Period averages				
1995-99	97,1	95,8	98,4	95,4
Average growth rate				
1995-99	2,1	1,7	2,4	2,0

*Source: model calculations*

Nonetheless, there are some serious shortcomings that must be acknowledged. Firstly, there is little feedback from environmental variables to macro-variables in the base run. Pollution matters, but the model never "sees" the effects on productivity, health, biodiversity or anything else. In this way it may be argued that the model is biased towards the short-run. Secondly, the model avoids the highly unrealistic assumption that all resources are fully utilised and, therefore, environmental protection bears a heavy opportunity cost. There is excess capacity and unemployment so that the principal constraints come from the institutional environment in which the economy functions. The paper shows that it is impossible to evaluate the effects of green trade restrictions on the economy independently of assumptions about the macroeconomic environment. Given the complexity of the institutional and associated policy-making framework currently governing South Africa, it should not be surprising that the opportunity cost of environmental protection is less than in the conventional neo-classical analysis.

These caveats aside, the message of the simulations in this paper is that the threat of green trade restrictions on the macroeconomy cannot be taken lightly. If green trade restrictions are imposed either on mining or non-traditional exports, the consequences for macroeconomic performance will be significant. It makes some, but not much, difference if the green trade restrictions are levied against raw materials versus manufactured goods. The message of this paper is that the cost of green trade restrictions to South Africa will be very high when compared to the costs of clean up. The simulations show that the differences

**TABLE 15** Gaseous emissions for green trade restrictions on non-traditional exports  
(ratios to base run)

Year	Locally harmful emissions				Greenhouse gases			
	Total	Partic	SO <sub>2</sub>	NO <sub>2</sub>	Total	CO	CO <sub>2</sub>	CH <sub>4</sub>
1994	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
1995	99,2	99,1	99,4	99,1	99,1	99,1	99,1	100,0
1996	98,1	98,0	98,6	98,0	98,0	97,9	98,0	99,9
1997	96,6	96,4	97,4	96,4	96,4	96,3	96,4	99,5
1998	94,8	94,4	95,8	94,5	94,5	94,5	94,5	98,7
1999	92,8	92,3	94,0	92,5	92,5	92,4	92,5	97,4
Period averages								
1995-99	96,3	96,0	97,0	96,1	96,1	96,0	96,1	99,1
Average growth rate								
1995-99	1,8	1,3	1,9	2,0	2,0	2,0	2,0	1,3

*Source: model calculations*

in the production of greenhouse gases and, thus global warming, will be almost negligible, nor is there much to be gained in changing the composition of local versus global externalities.

While the macroeconomic effects of green trade restrictions are striking, it should be noted that only extensive environmental decay is measured here. Moreover, intensive degradation in South Africa is unquestionably local in its impact. Thus, to the extent that policies raise the Gini coefficient, the burden of environmental decay is not measured properly by the damage function. Typically, a deterioration in the distribution of income forces the poor and unemployed to increase the rate at which the environment is exploited. A contraction in output substitutes intensive for extensive environmental assault, and the environmental protection inherent in lower levels of economic activity is undermined. In the simulations above, changes in real wages overpowered the effects of unemployment and the distribution of income improved. It is unlikely, however, that this effect would persist if output were further reduced. Eventually, green trade restrictions would reduce employment to the point that intensive degradation, most likely of soil and water supplies, would increase dramatically. This observation further strengthens the general conclusion that South Africa must do everything within its power to minimise the risk of green trade restrictions being implemented, including cleaning up, before they become a real threat.

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## chapter 5

# REGISTERING POLLUTION

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## The prospects for a pollution information system

Michael Goldblatt

### Introduction

All economic activity is derived from a set of environmental resources and services.<sup>1</sup> Simultaneously, however, the current functioning of economic systems depletes and degrades these resources and services in a variety of ways. Modern industrial economies are pulling the environmental rug from under their own feet. The degradation of environmental support systems occurs by two routes: a depletion of resources necessary for the continued viability of the biosphere (such as water resources) and pollution of the biosphere such that its functioning and its continued ability to assimilate waste materials from economic processes (such as ozone-layer destruction) are impaired.

The primary unsustainable activity of economies was previously thought to be the depletion of non-renewable natural resources—the running down of stocks of minerals and metals to construct, and fuels to power, the economy. However, it has become clear that pollution caused in the extraction and use of these resources is going to constrain their current methods of use well before they are in danger of depletion (Jacobs 1992). Waste products from industrial societies are entering the environment at a rate far greater than the rate of natural absorption and breakdown of these substances. Furthermore, much of the waste from industrial processes is in the form of substances which are either toxic or extremely resistant to natural degradation.

The environmental effects of pollution are myriad and occur at all levels—from the key global problems of ozone depletion and global warming, to local and regional problems of acid precipitation from sulphur and nitrogen oxide emissions. Pollution also directly endangers human health. According to Jacobs (1992), a study by the United States Environmental Protection Agency of toxic air emissions in the USA has directly linked

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<sup>1</sup> I would like to thank Iain McGlinchy of the Ministry of the Environment, New Zealand, and Achim Halpap, of the United Nations Institute for Training and Research, for their help in providing me with access to information on pollution release registers from around the world.

2 000 cancer deaths each year to a mere third of these emissions. The World Commission on Environment and Development concluded that "the sources and causes of pollution are far more diffuse, complex and interrelated—and the effects of pollution more widespread, cumulative and chronic—than hitherto believed" (1987: 211).

South Africa is not immune to these problems and, in fact, is less prepared than most industrialised countries to control industrial pollution. This chapter evaluates South Africa's hazardous waste production and management situation. It considers the need for an integrated pollution control system in South Africa and the central role that reliable information will play in the effective operation of such a system. In particular the paper evaluates the use of pollution release inventories, how they have been used in other countries, how an inventory would relate to current pollution control processes and what the needs of a process of implementation are.

### Pollution control: A new industrial sector

Internationally, governments and industries have rapidly responded to the growing problems of pollution control through legislation, new technology, changed industrial processes and large expenditures on pollution control equipment. The control of pollution to air, water and land media constitutes the largest area of environment protective expenditure in developed countries. During the last decade public and private expenditure on pollution abatement in Organisation for Economic Cooperation and Development (OECD) countries ranged from 1-2% of GDP, with expectations of steep rises. By the year 2000 the USA expects to raise its pollution abatement expenditure from \$115 billion to \$171 billion in real terms, equivalent to about 2,8% of GDP (Doeleman 1992).

Certain industrial sectors have expenditures far higher than the national averages for pollution control. It is estimated that between 10-20% of Western Europe's chemical industry capital expenditure in 1989 was channelled towards environmental spending. This was of a total of about \$25 billion and was expected to rise to about 25% of total capital expenditure in the 1990s. Most of this was from waste elimination (International Labour Organisation 1994).

There are no comparative figures for South Africa, but in all likelihood expenditure in South Africa makes up a lesser, but growing, percentage of GDP than in the OECD nations. As the World Commission on Environment and Development report pointed out, "pollution control of industry has become a thriving branch of industry in its own right in several industrialised countries. ...looking to the future, a growing market for pollution control systems, equipment and services is expected in practically all industrialised countries, including newly industrialised countries" (World Commission on Environment and Development 1987).

It is evident that pollution control is internationally becoming a significant industrial sector and is absorbing a significant percentage of industrial investment and expenditure. Pollution control is a growth area driven largely by legislation, public pressure and corporate risk aversion. However, for a sector so dependent on public policy there is surprisingly little information publicly available in South Africa. The size, geographical extent, projected growth and other essential data for this aspect of industry are little known.

As Rogerson points out, "environmental scientists in South Africa largely have eschewed research which identifies clearly the geographical sources of pollutants or hazardous industrial waste" (Rogerson 1990). There is scant data on the actual levels of industrial releases of pollutants, of their composition, of projected releases or of acceptable levels of releases. Furthermore, of the existing data only a small part is held by the state or publicly available.

### **The waste legacy and its costs**

The history of solid waste management in South Africa also provides some compelling reasons to review the management and control of pollution. South Africa has a legacy of poor management of solid waste in general and toxic substances in particular, and as yet no significant policy to either remedy past failings or to ensure that releases of hazardous chemicals to the environment are properly monitored, controlled and limited to acceptable levels. According to waste management company Waste-Tech, South Africa is " saddled with a waste management problem of historic proportions" (Waste-Tech, undated).

Even if improved management is instituted in the near future, there are significant costs that will probably have to be borne in order to remedy the poor practices of the past. There are between 1 200 (Moon 1995) and 1 600 landfill sites in South Africa (Noble 1995). A survey of 541 of these sites (Department of Environmental Affairs and Tourism 1992) found that only 92, or 17%, were licensed. Furthermore, although most of these were not hazardous waste sites, nor designed as such, many of them had accepted some industrial waste at some stage. Conditions that could lead to contamination of water resources existed at over half of the landfills, and many accepted waste for which they were not designed. The same study found that almost no landfill sites have records of substances accepted which go back more than ten years. Even recent information is scanty, as only the sites run by the larger organisations keep waste-acceptance databases.

The economic, social and environmental implications of this are enormous. It is very difficult to ascertain the clean-up costs associated with the remediation of unsuitable sites contaminated with hazardous wastes. However, some ballpark figures can be provided to show the expenses generated by an inadequate waste management system.

The USA has the longest and most comprehensive experience of environmental clean-up. Following the passage of the Comprehensive Environmental Response, Compensation and Liability Act, commonly known as Superfund, the Environmental Protection Agency was tasked with the enormous job of cleaning up over 2 000 priority contaminated sites (Davis and Hyfantis 1993). The experience gained thus far in this process will prove very useful in providing data on the use of technical, legal and economic instruments in the remediation of toxic waste contamination in South Africa.

Davis and Hyfantis (1993) have estimated the average clean-up costs thus far under Superfund, and have also estimated the costs for less stringent remediation scenarios:

- scenario 1 is the actual documented cost estimates for the remedial programmes currently proposed (\$32 million per site);
- scenario 2 involves merely fencing off sites and monitoring contaminated groundwater to ensure that contamination does not migrate (\$2,1 million per site);

- scenario 3 adds certain technologies which further reduce toxin mobility such as capping, vertical barriers and surface water diversion (\$6,6 million per site).

To determine South Africa's clean-up costs the number of sites requiring remediation needs to be estimated. As indicated, lack of information means that any figure will be associated with a high degree of uncertainty. Nevertheless, going on the available information we can derive some ballpark figures. Using only the information from the sites actually covered by the Department of Environmental Affairs survey—a very conservative estimate—we can see that of the Class I (containment) and Class II (attenuation) sites surveyed, 105 admitted to having control problems. If we use the study's assumption that over half of these were accepting hazardous industrial waste, then there are at least 52 sites with potential contamination problems. This is probably a highly conservative estimate, noting that only 16% of Class I sites even had leachate monitoring, and only 4,6% of Class II sites had monitoring.

Based on a rough figure of 52 sites requiring clean-up and based on the USA costings, possible costs for South Africa are:

- \$1,664 billion (R6,074 billion) for scenario 1;
- \$109 million (R398 million) for scenario 2, and;
- \$343 million (R1,252 billion) for scenario 3.

Even the smallest amount is a substantial cost for a new waste management system to deal with. In addition to this cost of remediation there are other significant backlogs of hazardous waste already within the system. These include asbestos-mining overburden, buried under soil, and other mining backlogs in the form of semi-purified concentrates containing zinc, copper, cadmium or cobalt. A variety of industries have privately managed on-site solid waste backlogs from evaporation or gravitation ponds (Department of Environmental Affairs and Tourism 1992).

Also significant are those hazardous materials still in circulation in the economy. About 228 000 tonnes of asbestos have been used since 1960 to manufacture numerous products—many of which are still in use. Thus, a large flow of asbestos-containing material will still be entering the hazardous waste stream for many years to come. A similar situation exists with respect to polychlorinated biphenyls (PCBs). Although PCBs are not used for new equipment anymore, it is estimated that about 2 000 tonnes of PCBs are still in use in existing equipment. Most users have been storing old contaminated equipment until there are adequate sites or technology able to deal with it. As with asbestos there is, therefore, an annual estimated waste stream of PCBs of about 300 tonnes despite them having been phased out of production. The cost implication of just this backlog is an estimated R350—400 million cost for the replacement of PCB-containing equipment (Department of Environmental Affairs and Tourism 1992).

These estimated costs may seem alarming but they are not unrealistically high. Other countries with far better histories of waste management than South Africa, albeit in the context of greater industrialisation, have arrived at similarly high figures in estimating their clean-up costs. Estimates include \$10 billion for the Federal Republic of Germany, more than \$1,5 billion for the Netherlands and at least \$60 million for Denmark.<sup>2</sup> Calculations in the UK have

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<sup>2</sup> These estimates are from an OECD secretariat paper, Paris, 1986, and are cited in World Commission on Environment and Development 1987.

suggested that \$11 billion-\$50 billion will be needed to clean up an estimated 50 000 to 100 000 polluted industrial sites (International Labour Organisation 1994).

What has become clear through the experience of Superfund in the USA and clean-up efforts in other countries, is that remediation is costly (Davis and Hyfantis 1993). It is undoubtedly preferable, and more cost-effective, to take a preventative approach to hazardous waste management. South Africa's potential remediation costs, although probably still at a manageable level, will use up resources that could be far better used to generate economic development. The country cannot afford to continue to bear the costs of environmental neglect. At the same time, we have the opportunity to move onto an industrial development pathway which includes as one of its integral aims, along with job creation and economic growth, a preventative hazardous waste management strategy. This needs to be built on the basis of minimising or eliminating the production and release of toxic materials into the environment.

### **The need for integrated pollution control**

Environmentally sustainable development depends on the protection of a country's natural resource base and on ensuring that the assimilative capacity of the environment is not exceeded. An effective pollution reduction, control and monitoring system is, therefore, vital for the future sustainable development of the country. Increasingly world attention is focusing on regulatory frameworks in which the minimisation or prevention of toxic wastes is prioritised—rather than merely the management of their disposal (Hirschborn, Jackson and Baas 1993). Even more fundamentally it is increasingly accepted that in the long-term it is necessary to reduce and eventually remove the production and use of hazardous substances in industrial systems.

One of the ultimate goals of industrial pollution control should be to change our industrial systems to one which does not depend upon hazardous materials. The emerging approach to industrial environmental management is a preventive one which focuses not on the so-called 'end-of-pipe' control of pollution, but on the introduction of clean technology and on changes in the processes of production.

Given current production methods and consumer demands, however, in the short-term there is still a need for mechanisms of control over the volumes and types of substances entering the environment. As outlined in Agenda 21 (Chapter 19),<sup>3</sup> which deals with the sound management of toxic chemicals, these mechanisms include (United Nations Institute for Training and Research 1995):

- adequate legislation;
- information gathering and dissemination;
- capacity for risk assessment;
- establishment of risk assessment policy;
- capacity for implementation and enforcement;
- capacity for rehabilitation and remediation;

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<sup>3</sup> United Nations Conference for Environment and Development, 1992

- effective education programmes; and
- capacity to respond to emergencies.

To this list we could add the need for integration of control across environmental media.

South Africa does not have these basic hazardous substances control elements in place. In fact, according to the Department of Environment Affairs and Tourism (1992) South Africa "does not possess a coherent, effective system for regulating hazardous waste"—let alone a strategy to begin minimising hazardous waste production. In the light of this 1992 report and other indications of serious flaws in the South African pollution control system, a process to develop an integrated pollution control system has been launched. The ultimate aims of this are, firstly, "holistic pollution control which should be comprehensive enough to cover all activities that impact significantly on the water, air or land environmental media, over the full-time scale of the effects of these activities" and, secondly, "integration of pollution control, which should be so organised as to consider discharges and emissions to all environmental media in the context of the effect on the environment as a whole" (Department of Environmental Affairs and Tourism 1994).

Although serious problems have been raised with the process of establishing South Africa's integrated pollution control system (Lukey 1995), there is general support for an integrated approach to pollution control. A key problem in South African environmental control, and one which is well-recognised, is the uncoordinated fragmentation of environmental legislation and regulation between government departments and between levels of government. This situation has been recently exacerbated by the Constitution's delegation of environmental protection to the provincial governments. There are now nine new government structures, each with some responsibility for environmental protection but each with different structures, policy responses and capacities. The potential for coordinated responses are slim without an integrated system incorporating a central role for the national government.

Apart from the integrated pollution control process there are other policy initiatives and imperatives that are having an impact on pollution control. These include South Africa's obligations under the Basel Convention, new guidelines from the Department of Water Affairs and Forestry on the management, handling and disposal of hazardous waste (Department of Water Affairs and Forestry 1994), the environmentally sound management of dangerous materials programme of the Department of Environmental Affairs and Tourism (1995), and a range of policy initiatives being considered by the new provincial environment departments. Although some progress is being made in developing more effective approaches to the control of hazardous and non-hazardous pollutants, little attention has been paid to the question of whether there is sufficient information of a sufficiently reliable quality on which to base informed policy decisions.

### **The role of information in pollution control**

A major impediment to environmental management in South Africa is a shortage of accessible information. Sometimes access to information is restricted, sometimes it is difficult to locate and sometimes it is in a format hard to use—but more often than not it simply does not exist. The absence of reliable environmental information has been highlighted by many

of the chapters of this volume and poses a serious obstacle to effective environmental management.

Any management system of the complexity of an integrated pollution control system must be based on one that is a reliable, consistent, easily retrievable and usable. Pollution cannot be effectively controlled unless its sources are known. Future planning and resource allocation cannot take place without knowing the extent of the problem; nor can goals be set or success measured without having a system which allows progress to be monitored from year to year. South Africa lacks such an information system.

### **The current information situation**

Nobody knows how much hazardous waste is produced in South Africa annually. There is no central database on the quantities or types of hazardous pollutants released into the environment. No government department has been tasked with providing such an overview. Furthermore, the information which is available does not provide a breakdown of who releases hazardous wastes, where it is released and its final destination.

In the public sector the two authorities responsible for pollution control are the departments of Environmental Affairs and Tourism and Water Affairs and Forestry. The Department of Environmental Affairs and Tourism and its chief air pollution control officer, in particular, are the principal authorities charged with the management of air pollution (Petrie, Burns and Bray 1992). The Department of Water Affairs and Forestry has principal responsibility for the management of water pollution (Lusher and Ramsden 1992). Furthermore, the Department of Water Affairs and Forestry is responsible for the licensing of landfill sites and, hence, has a large role to play in the control of landfilled waste—including hazardous waste. These two authorities also are the main repositories of available information on hazardous pollutant releases. In both cases the information comes primarily from their permit procedures.

According to Noble (1995), due to the method of collection, this pollutant release information is neither complete, nor in a very useful format. The air pollution data is only for so-called 'scheduled processes' under the Atmospheric Pollution Prevention Act 45 of 1965 and, thus, covers only permitted establishments and those substances permitted. At present there are about 2 000 permits in operation, covering about 1 200 industrial sites (Petrie, Burns and Bray 1992). Similarly, only effluent from releasers subject to a permit, and only those substances or parameters listed in that permit, are recorded by the Department of Water Affairs and Forestry. Furthermore, the format of this data is inconsistent and is not suitable for year-to-year monitoring of nationwide pollution releases, nor for analysing pollution data geographically.

In general, therefore, there is little knowledge of types, quantities or locations of a wide range of hazardous substances released into the environment. This applies to the generators of the waste as much as it does to the regulators. The 1992 Department of Environmental Affairs and Tourism study (1992b) found that in the private sector "very few industries have waste management strategies or plan their waste management before starting up". Further, neither government authorities, nor waste facility managers have "annual statistics or databases available. Only a few operators of waste facilities and trans-

porters of waste have detailed knowledge of the waste they handle. ...Further shortcomings revealed include a...lack of information reaching decision-makers, operators and others either responsible for hazardous waste management or affected by it".

### **Availability of information**

Information which is held by government authorities is also not readily available to the public or even to academic researchers. Under the Atmospheric Pollution Prevention Act there is a blanket secrecy provision (section 41) which provides that no information can be disclosed without the consent of the person carrying out the undertaking unless it is for the purposes of legal proceedings arising out of the Act. The Water Act 54 of 1956 has no direct statements of confidentiality but it is the general practice of the Department of Water Affairs and Forestry not to release permit details without the consent of the pollution discharger. There are currently no general rights of public access to information on pollutant releases.

A culture of secrecy has developed among South African industries, with many loathe to divulge environmental information—especially that information which may reflect badly upon the company. This is partly due to the legal protection they enjoy, partly due to mindsets developed during the apartheid era, especially in the parastatals, and partly due to inexperience with public interaction. The Department of Environmental Affairs and Tourism survey (1992) said that a "severe limitation on the interpretation and presentation of the findings was the requirement of major generators for confidentiality".

The fears encountered during the survey were so serious that one major industrial generator only allowed an interviewer onto the premises after ensuring that he had no pens or paper on him. The company took the notes during the meeting and forwarded them to the interviewing team many months later. So onerous were the confidentiality agreements for the study overall that all the raw data—the largest collection of hazardous waste data ever gathered in the country—was destroyed after the final report was published to ensure long-term confidentiality.

### **State of the nation: The Department of Environmental Affairs and Tourism survey**

In recognition of the dire shortage of information on hazardous waste and of the fact that "of all the areas of environmental management, hazardous waste management has had the least attention in this country", the Department of Environmental Affairs and Tourism initiated an investigation into hazardous waste in 1989. Its purpose was to analyse the situation and propose a regulatory system to deal with the gaps in the legislation. As the report notes, "South Africa has had air and water pollution legislation on the statute book for many years, but has only incomplete legislation relating to waste. What there is does not address the question of hazardous waste." The final report, entitled Hazardous Waste in South Africa (Department of Environmental Affairs and Tourism 1992), although released in 1992, provides the most up-to-date and comprehensive report on hazardous waste production in South Africa.

Some of the major results of the survey are outlined below to give an idea of the scale of the hazardous waste management problem in the country. It must be borne in

mind that in the uncertainty analysis of the Department of Environmental Affairs and Tourism report it states that "from the outset of the investigation, it was clear that reliable data on hazardous waste generation in South Africa would be very difficult to obtain. Even the costly survey planned was obviously not going to be able to yield a very accurate assessment of the *status quo*" (Department of Environmental Affairs and Tourism 1992, Volume 1: 52).

Waste was defined as the by-product from a process that is stored for three months or longer, or enters the environment or leaves the premises. This includes waste in air, water and solid waste streams. Hazardous waste was defined as any waste representing a threat to human health or the environment through risk of explosions or fires; chemical instability, reactions or corrosion; infections; acute or chronic toxicity; cancers, mutations or birth defects; ecotoxicity; or accumulation or persistence in the environment.

A hazard rating was defined under which Group 1 (high hazard waste) was waste that required the most urgent and strict control due to significant concentrations of extremely toxic constituents that are also persistent in the environment and bio-accumulative. Group 2 (moderately hazardous waste) was defined as waste with highly dangerous characteristics or that which has significant concentrations of either highly toxic constituents, or moderately toxic constituents that either persist or bio-accumulate. According to Noble (1995), one of the chief authors of the report, the hazard rating was fairly conservative in that it did not overstate the hazardousness of the waste reported.

The report found that a total of 1,89 million tonnes of hazardous waste were generated annually in South Africa. Of this 59% was carried in waste water, and 93,6% of this waterborne hazardous waste stream was cyanide-containing effluents from gold-mining. Air emissions accounted for 18% of the total and the rest (23%) was comprised of solid wastes, sludges, emulsions, tars and slurries. The waste streams and their quantities present a profile which differs substantially from that found in other countries, with the total being dominated by a few very large waste streams. These included mining and coal-burning wastes (Department of Environmental Affairs and Tourism 1992).

Table 1 below shows the industrial breakdown of the total and hazardous waste streams. The table excludes non-estimated sources, such as agriculture and forestry, domestic and trade refuse, domestic smoke, vehicle emissions and sewage sludge. The contribution of these non-point (diffuse) and unreported sources to the total hazardous waste stream is potentially very substantial. It can be seen that gold-mining dominates the total stream, with most of it being Group 2 waste. The Group 1 (high hazard waste) component of the hazardous waste stream was dominated by non-metallurgical manufacturing industries.

### **Pollution information systems**

Given the need for better information on the production and release of hazardous pollutants, it is useful to consider approaches to the collection, management and dissemination of this type of information in other countries. This problem is not one that is unique to South Africa—many countries, particularly in the developing world, have little knowledge of their levels of pollutant releases. It is only fairly recently that even the more indus-

**TABLE 1** Total SA hazardous waste streams—Group 1 and Group 2 waste combined  
(millions of tonnes per annum)

Source	Total waste	Hazardous waste (groups 1 and 2)
Gold-mining	191,7	1,00
Coalmining	45,6	0
Other mining	139,9	0,05
Non-metallurgical manufacturing industries	15,4	0,45
Metals and metallurgical industries	4,9	0,33
Power generation	20	<0,01
Service industries	1,2	0,03

(from Department of Environmental Affairs and Tourism 1992)

trialised countries have implemented comprehensive and integrated systems of pollution monitoring and recording.

This broad problem of lack of information was considered at the United Nations Conference on Environment and Development. The document arising from the conference, Agenda 21, recognised both the need for reliable environmental information and a more general right to information. In this regard it recommended that all countries establish pollution tracking and inventory systems (Young 1994). Probably the best developed example of these is the USA Environmental Protection Agency's toxic release inventory programme, which provided some of the bases for the Agenda 21 recommendations. More recently the OECD has been developing generic guidelines for the establishment and use of these systems. The generic term for these programmes as used by the OECD, is pollution release and transfer registers, which similarly will be used here.

### Pollution release and transfer registers

A pollution release and transfer register is a relatively simple concept which can easily be adapted to national environmental protection needs. Simply put "a [pollution release and transfer register] is a catalogue or register of potentially harmful pollutant releases or transfers from a variety of sources. A [pollution release and transfer register] generally includes information about releases or transfers to air, water and soil as well as about wastes transported to disposal sites. A [pollution release and transfer register] includes reports about specific species such as benzene, methane or mercury as contrasted with broad categories of pollution such as 'volatile organic compounds', 'greenhouse gases' or 'heavy metals'" (OECD 1994).

The register is compiled from data gathered through a generally mandatory system of reporting from point source polluters. They are expected to report regularly on the quantities of their releases of chemicals from a predetermined list, plus other information use-

ful in the control of hazardous pollution. Some systems also attempt to calculate non-point releases by means of estimates using monitoring data, statistical data and emission factors. These diffuse sources could include substantial polluters such as agriculture and transport.

Three main reasons provide the rationale for the establishment of a pollution release and transfer register: the first is the right for the public to have access to environmental information to enable them to participate in pollution control activity; the second is the need for comprehensive and accurate pollution release information for environmental management authorities; and the third is to encourage and improve pollution reduction.

### **Making the right to know meaningful**

A pollution release and transfer register can be seen as a step towards meeting some of the key principles for sustainable development outlined in Agenda 21—specifically the principles that environmental issues are best handled with the participation of all concerned citizens and that each individual shall have the appropriate access to information to make this participation meaningful. Agenda 21 makes specific reference to the need to provide information to non-governmental organisations and civil society about accidental and routine pollution releases.

In the light of this, the USA toxic release inventory is not only important because it is the earliest and best-developed pollution release and transfer register system—it is primarily significant because of its origins in the 'right-to-know' movement in the USA. Public access to information was a hard-fought battle in the USA, as in other countries, with the toxic release inventory being a notable victory. In the environmental arena the initial thrust for guaranteed access to information on hazardous substances came from trade unions and other worker organisations. Their demand for entrenched worker and community right-to-know provisions was given impetus by the Bhopal disaster in December 1984, when an accidental methyl-isocyanate release from a Union Carbide plant in India killed about 2 000 Bhopal residents.

Shortly afterwards, this disaster was followed by a large pesticide release at a Union Carbide plant in West Virginia. This accident, although far less serious (about 130 people had to receive emergency treatment), brought the realisation that chemical disasters could happen closer to home. This realisation helped to further promote joint union and environmentalist pressure for a more open flow of information about potentially hazardous substances.

The Environmental Protection Agency proposed a voluntary chemical emergency programme which was rejected by the USA Congress as not being stringent enough and was replaced by legislation that imposed strict requirements on all major producers and users of toxic substances. The Emergency Planning and Community Right to Know Act, of which the toxic release inventory forms part, was a major step forwards in extending the right-to-know principle from the workplace to the general community (Robinson 1991). The Act comprises three parts: the first deals with hazard communication and requires reporting on hazardous chemical inventories; the second requires facilities to submit annual records of their environmental emissions of toxic substances; and the third establishes state and local planning committees to develop plans in response to the data generated by the first two sections (Environmental Protection Agency 1988).

All data collected under the toxic release inventory is made publicly available through a variety of means, including written and electronic media. This allows citizens and environmental groups to be aware of major sources of toxic pollutants in their neighbourhood and to compare one company's performance against another. The resulting public pressure on companies to perform better has led to many voluntary programmes to reduce the production of waste and to dispose of what is produced in a safer manner.

### **Providing the basis for public participation in pollution control**

Public release of the toxic release inventory has been used by grass roots environmental and community groups around the USA to oppose industrial pollution. More than 150 reports on local, regional and national hazardous pollution problems have been produced by these groups using toxic release inventory information, and these have helped to pressure polluters to improve their environmental performance (Young 1994). The toxic release inventory data has "lent authority to people advocating changes in regulatory and corporate policy regarding toxic pollution" (Maclean 1993).

The toxic release inventory information is also the first federal database that Congress required to be released to the public in a computer-readable format. A right-to-know network was subsequently established, using a computer bulletin board system to make toxic release inventory data available to anyone wishing to collect the information electronically. This has provided the basis for numerous local activists to educate other citizens, establish advocacy groups and generate media attention to pollution problems (Maclean, 1993).

Although non-governmental organisations and public interest groups are important users and transferers of pollution release and transfer register information, it is not only these activist groups who use pollution release and transfer register information. Journalists have indicated that the publicly available information of a pollution inventory promotes increased communication among local industry officials with the public and with the press. And, in the financial sphere, pollution release and transfer register results are used by investment analysts and insurers to assess potential liabilities and risks and to compare firms' environmental performance (OECD 1995c). These disparate users have different needs from a pollution register and this needs to be considered in the design of the system.

### **Information for government planning and policy**

Environmental policy formulation depends on reliable and adequate information. A toxics inventory can help to provide this—distinct from any role it may have in satisfying the public's right to know. The key proviso to remember is that an inventory cannot be seen in isolation. A stand-alone inventory will not control pollution unless supported by a regular, monitored and enforced system; public pressure; and financial incentives and political will from government. At the same time, a reliable inventory forms a crucial element of all these aspects of pollution control.

It provides the basis for state-of-the-environment analyses at a variety of spatial scales. Information about the pollution burden can then be used to assess the effectiveness of existing controls and to target priority areas and pollutants (Foran and Glenn 1994). A national pollutant inventory could provide the basic information component of an integrated pollution control system. The OECD reports that government officials "especially at regional or local levels, often use [pollution release and transfer register] results to compare with license requirements which set limits for releases. They also compare similar facilities in order to identify candidates for inspection" (OECD 1995c).

Under an integrated system an inventory approach may also help to harmonise existing reporting requirements and to reduce the reporting burden on firms. This could include the integration of national monitoring of controlled chemicals to be reported under international obligations, and mechanisms to estimate the releases from non-point sources and from small and medium-sized firms.

In addition to these functions, an inventory provides a broader range of possibilities for government. Inventories have already been used for targeted programmes for the reduction of specific priority pollutants and for help at a local level with land-use planning and licensing decisions. The USA toxic release inventory has also been used successfully by the Environmental Protection Agency to demonstrate the comparative risks of different hazardous waste management alternatives. For example, a 1993 study used the toxic release inventory to compare 'normal' releases reported under the toxic release inventory of a set of organic compounds with the potential mass of the same compounds emitted by hazardous waste incineration (Dempsey 1993). The study showed that, compared with 1990 toxic release inventory releases, the emissions of the incineration compounds were very small. The information served to put the risks from incineration into a context where more direct and useful comparisons of environmental impact and health risk could be made.

At a broader policy level a properly established pollution release and transfer register can aid in the process of establishing pollution release data per unit of production for various industrial sectors. This type of data is particularly important in any attempts to model the environmental impact of different growth scenarios. Releases per unit of production is dependent on the production process, on technology and on pollution abatement measures and is, thus, unique to each country. It is, therefore, important to establish these environmental factors of production for the local economy to aid in incorporating environmental impacts into industrial planning.

Finally, a pollution register can relatively easily be linked to the use of economic instruments. The use of financial instruments for the control of pollution is becoming established as an effective and equitable method of environmental management. Economic instruments are necessary components of an integrated pollution control system, both to ensure the application of the polluter-pays principle and to generate revenue for the running of the system itself. Only by the monitoring of the polluters can this principle be enforced. Pollution registers have already been used for this application: in one instance recorded by the OECD, regional officials linked pollution release and transfer register data to the taxes imposed on firms in their area with a poor record attracting higher taxes (OECD 1995c).

## A driving force for pollution reduction

Possibly the most immediately apparent benefit of a pollution release and transfer register is that it can act in a number of ways—separate from direct legislative control—as a force driving targeted pollution reduction. This aspect of pollution release and transfer registers has been demonstrated conclusively already, and is one of the most exciting reasons for implementation. These ‘voluntary’ impacts that a pollution release and transfer register can have on levels of pollution releases are due to a range of different factors. These range from fears of poor public image to internal effects on organisations generating pollution to simply the provision of a benchmark to set targets. Some of the main ways in which pollution release and transfer registers have been shown to aid in pollution reduction are outlined below.

- ***Voluntary agreements: the 33/50 programme***

Although it is generally acknowledged to have shortcomings, the toxic release inventory is also described as the most successful tool the Environmental Protection Agency has ever used to reduce emissions of toxic substances. Between 1988 and 1992 there was a 40% decline in releases of 17 priority toxic chemicals, primarily through toxic release inventory-linked voluntary reduction programmes established between the Environmental Protection Agency and companies who chose to be involved (United States 1993a, 1993b, 1994a). In real terms this means that chemical emissions declined by 272 million kilograms. Reduction was largely achieved through the Environmental Protection Agency’s 33/50 programme, which used voluntary targets and technical assistance to promote pollution reduction in industry. Based on a list of 17 priority toxic release inventory chemicals, the Environmental Protection Agency set the goal of a 33% reduction by 1992 and a 50% reduction by 1995. Indications are that this 50% target was reached well ahead of schedule.

Over 1 200 firms have joined the programme, benefiting from both reductions in waste materials generated and in positive publicity from the 33/50 programme (United States 1994a, 1994c). The Environmental Protection Agency says that by contacting the chief executives of the parent companies of toxic release inventory facilities that report 33/50 programme chemicals, they seek to instil a pollution prevention ethic among the highest echelons of American business (United States 1994d). The Environmental Protection Agency found that companies participating in the programme reported higher reduction levels than other USA companies, that the targeted chemicals were reduced significantly more than other toxic substances and that the number of participating companies is growing.

However, some reservations must be noted about the replication of such promising results in South Africa. Firstly, it must be recognised that the toxic release inventory is only one piece of legislation among other existing controls which strictly monitor and regulate toxic substances in the USA; for example, under the USA Pollution Prevention Act of 1992, companies also have to reveal what they are doing to prevent pollution. It is possible that such reductions in emissions may not be possible in South Africa because of the lack of infrastructure to enable and enforce compliance. A further issue that the Environmental Protection Agency points out is that larger companies are much

more willing to participate, while smaller companies are more reluctant to get involved. Depending on the relative pollution impact from differently sized establishments, this could also affect the functioning of similar programmes in South Africa.

At the same time it may follow that equivalent or even larger reductions could be possible in South Africa for two reasons: firstly, our concentrated economy may mean that large companies may contribute to pollution in higher proportions than in the USA and, secondly, given our lag in pollution control and technology, the pollution baseline may be higher here, thereby making rapid reductions relatively easy.

### *Influencing company management*

Apart from the potential of voluntary government-industry programmes, pollution inventories may have other direct effects on industrial performance. As Cairncross (1992: 291) points out, "no management tool is more powerful than information". Company managers are often surprised by the quantities of hazardous waste that they are discharging, both in terms of the actual production costs of their waste and in terms of the environmental impacts of their production. According to Cairncross, nothing has galvanised senior management in the USA as much as the reporting requirements under the toxic release inventory. She quotes a company manager as saying "unless you measure something you don't really control it".

The reporting procedures under a pollution release and transfer register serve to make companies aware—generally for the first time—of the substances they are actually releasing and the potential hazards involved. They also enable companies to set corporate policy by setting reduction targets and goals for managers. Requirements that senior managers, or the chief executive officer, actually sign the pollution release and transfer register submission, also ensures that these reports are seen by top management. This serves to educate management and to demonstrate the potential effects that this information could have on the company's profile. A major UK firm has found that the primary audience of its release data is its own workers who wish to know more about the risks of their company (OECD 1995c).

This 'self-education' would be particularly valuable in South Africa, where the Department of Environmental Affairs and Tourism (1992) hazardous waste survey found that most generators had never even carried out a simple mass balance of inputs and outputs and that most had "no figures available on waste generation". Of the limitations imposed on the department's study "the most striking to the interviewers was the widespread lack of knowledge encountered among respondents" (Department of Environmental Affairs and Tourism 1992). The company education intrinsic to a pollution register would go a long way to remedying this situation and thereby promoting pollution reduction at source and, hence, cleaner technology.

### **International experience with pollution release inventories**

Following the success of the USA toxic release inventory scheme, several other countries have introduced pollution release and transfer registers. These include Canada, the Netherlands and Norway. The Australian government is currently going through a process of

developing a national pollution inventory which is to a large extent modeled on the USA's toxic release inventory. The OECD and the EU are also investigating these issues, as are New Zealand, Mexico and Egypt. A few examples are given below to demonstrate the various structures and approaches used.

### **Canada's national pollutant release inventory**

Canada has a pollution inventory called the "national pollutant release inventory", which started collecting data in 1993. It was based to a large extent on the toxic release inventory, with some changes and additions. Under the Canadian Environmental Protection Act (Canada 1994a, 1994b), a substance that is regulated under another Act, such as a pesticide under the Pest Control Products Act, cannot be regulated under the Environmental Protection Act. This is done to avoid excessive regulatory and administrative burdens on industry. The American toxic release inventory included a lot of substances that were filtered out for this reason. Also, a number of the toxic release inventory substances are not used by industry in Canada (Beckett 1995). After all of this 'Canadianisation', the national pollutant release inventory includes 178 substances.

The substances reported are of concern to human health or the environment—it is not strictly speaking only a 'toxics' list. In the first year a total of 1 466 facilities filed reports in a process described as successful and well-received (Environment Canada 1995). As in the toxic release inventory some facilities are excluded, such as mining, wholesale and retail facilities and fuel storage. The inventory goes further than the toxic release inventory in that it estimates the releases of listed substances from mobile sources and from fuel distribution. It also includes sections on estimates of inventories of greenhouse gases and common air contaminants.

The establishment of the national pollutant release inventory was accomplished with the support of a multi-stakeholder advisory committee which included representatives from industry, labour, environmental organisations and from provincial ministries and federal departments. The stakeholders recognised that the national pollutant release inventory could change over time and could be improved and refined to meet new needs and objectives. As with the toxic release inventory, a range of supporting materials have been developed by Environment Canada to aid in the reporting and dissemination of the national pollutant release inventory data. These include (Environment Canada 1995a, 1995b, 1995c, 1995d):

- pamphlets on common questions;
- guides to reporting;
- computer-based reporting and reporting software user guides; and
- summary reports of the salient collected and aggregated information.

These materials make the inventory easily understandable and accessible, and are crucial to its successful functioning.

### **The UK's programme under Her Majesty's Inspectorate of Pollution**

The UK's pollution release and transfer register, termed the "chemical release inventory", uses monitoring information that is already collected as part of permit requirements un-

der the country's integrated pollution control system. This information is then made available centrally in a more accessible and useful format. Those facilities regulated by the integrated pollution control system are mainly the larger industrial sites which are the main contributors to the chemical release inventory. This has been a point of concern in the UK, with some groups calling for a broader scope for the inventory. As it stands, the chemical release inventory is really a site-by-site inventory rather than a pollution inventory as such (McGlinchy 1995b).

The process of establishing the chemical release inventory raised many of the issues dealt with above. A key issue debated was the inclusion of individual names of companies and a ranking of the worst polluters—which was called for by the Institution of Environmental Health Officers. The institution also stressed the importance of presenting the information in an interesting and user-friendly way, and the importance of using the inventory in conjunction with other elements of government policy, such as the national sustainable development plan. In particular, the institution suggested that the inventory should be used to set targets for local emissions reductions and to identify pollution black spots' (Institution of Environmental Health Officers 1993).

### Australia's national pollution inventory

The establishment of the Australian national pollution inventory was announced in 1992. Following this statement, A\$5.9 million was committed to developing the inventory, with the main justification for it being the public's right to know. Apparently there is strong grass roots pressure in Australia for this kind of information. The inventory was also linked to Australia's commitments under Agenda 21 (McGlinchy 1995a). The proposal is that the national pollution inventory be made up of six information modules consisting of a toxics release register, existing pollution release information, urban transport and smog issues, solid non-hazardous wastes data, intractable wastes information and greenhouse gas emissions data.

There is a committee overseeing the development of the national pollution inventory with representatives from the Commonwealth, state and local government, industry, small business, non-governmental organisations and community groups. One of the main priorities for this group is to develop the list of species to be reported. There is no agreed list of what should constitute the inventory at this time, and opinions vary quite markedly as to what should be included. The split has been summed up as industry wanting 'nothing' and community groups wanting 'everything' on the list. The initial list is likely to include aggregated groups of chemicals rather than specific substances.

One of the problems in drafting legislation for the national pollution inventory is the sometimes difficult ways that responsibilities are split between state and Commonwealth governments. Whatever happens, it is recognised that there must be cooperation from state governments for the national pollution inventory to work. This provides a useful lesson for South Africa, which faces similar issues.

In the short-term, the inventory may consist of a central and publicly accessible register of all information that is already required to be reported as part of state and local body discharge permits. Another major priority is to develop 'estimating techniques' for

emissions so that small companies, in particular, do not have to install expensive monitoring equipment.

The Australian situation sounds fairly similar to South Africa's situation. Several interesting issues have been raised in the Australian process which appear to be apposite to South Africa and which probably will have to be debated here as well. These include the following:

- industry is keen to include non-point source emissions, such as households and agriculture;
- there is strong pressure to require *all* companies using listed substances to report, not just the larger ones. There is general agreement that there is no logical reason for the proposed cut-off at 10 persons (based on the USA toxic release inventory) and this limitation will probably be dropped;
- the most appropriate method of facilitating community access to the information is as yet unresolved. There is a distrust of local government by some community groups, despite this being the logical place to put the information; and
- at which regional units should data be reported? Some companies are very wary about the inventory using too small a unit to record data, as this may allow identification of specific companies, whereas other groups are saying that this is precisely what the inventory is for.

The main lesson that can be learnt from the Australian experience is the need for a thorough, inclusive process of establishing an inventory. The Australian Environmental Protection Agency held a series of national workshops, and allowed written submissions as a response to a national pollution inventory discussion paper (Australia 1994). The agency then established a national pollution inventory reference group which includes representatives from the Environmental Protection Agency, the state governments, local government, community and conservation groups, industry associations, trade unions and a scientific adviser. They also used a series of trials and pilot projects of selected aspects of the national pollution inventory, such as data dissemination, substance lists and database management (Australia 1995). Special attention was also given to areas away from the large cities to establish community desires and needs from an inventory in smaller towns and rural areas.

### **The OECD and United Nations Institute for Training and Research's guidance to governments**

The OECD has been preparing a document entitled "Guidance to governments" on pollution release and transfer registers. It has been attempting to establish generic guidelines which governments can use as the basis for assessing the need for a register and for establishing one if this is seen as important. The process is aimed at being inclusive and includes developing, as well as OECD countries, non-governmental organisations and industry. It appears to be a useful process, with the basic principles of pollution release and transfer registers being outlined in the documentation, as well as the experience of countries with existing pollution registers being reflected.

The United Nations Institute for Training and Research has used the material from this process in a programme targeted at helping developing countries to improve their

pollution information systems. The institute has initiated a successful process in Mexico (Halpap 1995) where the concept of a pollution release and transfer register has been accepted. Currently, some small-scale pilot projects are being conducted in Mexico to assess the viability of the approaches adopted and to refine the system prior to instituting it nationally. The institute stresses the importance of an inclusive process in the set-up phase of a pollution release and transfer register to ensure its support by all stakeholders and to ensure its success. The Mexican process will be particularly useful for South Africa to examine because Mexico is the first 'developing' country to begin instituting a national pollution inventory. Its experience may be more appropriate for South Africa to learn from than that of the more industrialised nations.

### A pollution release inventory in South Africa?

The need for an improved data collection and management system for hazardous waste was strongly raised in the Department of Environmental Affairs and Tourism's report (1992) on hazardous waste. The current integrated pollution control process also makes provision for consideration of information needs. Given the clear need for improved and freely available information, it seems appropriate to initiate a process towards the establishment of a pollution register in South Africa, with the form and geographical extent of such a register depending on the objectives set for it. As early as 1992 the department noted that:

[A]t present there is a severe shortage of information for planning, decision making and public information. For all facets of environmental management to be effective, a database is urgently needed. It will be needed to aid regulation, both legislation and its implementation, research and strategic planning, commercial enterprises, and perhaps to provide a 24-hour regional emergency service. It will also be needed to provide data for reporting to the Basel Convention and other international bodies.

The department's report goes on to recommend in fairly general terms the establishment of a national database of types and quantities of hazardous waste being generated. It suggests that this database include the results of research into the impacts of hazardous substances, recycling methods and clean technology. It also suggests linking this to an "information clearing-house" which will publish documents on hazardous waste issues of public concern, carry out public education, respond to public queries and provide a means for the public to articulate their views to decision-makers. A principle underlying this proposed information system is that "access to information should be as free as possible".

A pollution release and transfer register could provide the backbone for this type of database, with the more ambitious aspects being linked to it at a later stage. Prior to the establishment of a pollution inventory of this nature, a number of issues will need to be more thoroughly considered and debated. These include determining:

- the prime objectives of the inventory;
- the list of substances to be included;
- who needs to report;
- who collects and manages the information;

- how the data is disseminated; and
- how it is to be financed.

There are numerous issues that will make the establishment of an inventory substantially different in South Africa from elsewhere, suggesting caution in merely adopting an approach already used elsewhere.

The special circumstances relate both to our industrial base and to our social context. For example, in the USA mining and utilities are excluded from the toxic release inventory, whereas these sectors are major contributors to the pollution load in South Africa. The increasing number of small and medium-sized enterprises in South Africa also pose particular constraints on an inventory. Many of these firms may need technical assistance in assessing and reporting their releases, and their large numbers will raise the administrative burden of an inventory. The particular needs and problems of this sector would need to be dealt with during the installation of a pollution release and transfer register.

The dissemination of data will also present special problems. Widespread publication in all 11 official languages would be extremely expensive. South Africa would also have difficulty in relying on computer networks as a viable solution. South Africa has nine computers per 1 000 citizens, compared to 265 per 1 000 in the USA and 134 per 1 000 in the UK (Young 1994). This does not necessarily mean that computers and Internet-based information provision will not be a useful and cheap method to use—it merely points to the particularities of the South African situation.

### **The need for an inclusive process of establishment**

Possibly the most important lesson that South Africa can learn from the international experience is the need for a thorough process of consultation in the development of a pollution release and transfer register. For a register to be successful it needs to be accepted as useful by all stakeholders: those doing the reporting (primarily industry), the authorities managing the system and interested and affected parties from the public. Without agreement on the objectives and scope of the inventory from these stakeholders it will be unable to fulfil its potential. At worst it will simply not function due to inadequate reporting and public disinterest.

### **Recommended course of action**

The current South African integrated pollution control process does not provide a successful model for a participatory environmental policy development process. However, there have been some inclusive policy development processes in other areas that have achieved consensus or compromise policies supported by the relevant stakeholders. It is entirely feasible to do the same with a pollution release and transfer register consultation process, given the correct political will and attitude.

Such a process need not be too complicated, although it would have to incorporate a fairly large number of elements. These have been outlined by the OECD and follow in a logical fashion. The first step is to establish a multi-stakeholder group that is representative and legitimate. It can then embark on a process which will consider the following

elements in an incremental process: the establishment of precise goals and objectives, the agreement on proper definitions of terms (such as 'release' and 'transfer'), a decision on the species list and on the scope of the inventory (such as point or non-point releases) and public sector reporting. The administrative details then need to be agreed on: which authorities manage the process, reporting thresholds, method and ease of reporting and data dissemination.

A range of potentially controversial factors will have to be considered in the process, but these need not be stumbling blocks as they have all been satisfactorily resolved elsewhere. Such issues include sanctions for non-reporting, the methods of dissemination, who pays for the inventory and issues of confidentiality. These last two will be briefly looked at to demonstrate how they have been handled in other systems.

#### ■ *Confidentiality*

An issue that is often raised by companies in relation to pollution release and transfer registers is the need to protect trade secrets or other industrially sensitive information which may be breached by a pollution release and transfer register. This has been dealt with in the legislation establishing release inventories in a number of countries. Under the USA toxic release inventory, reporters can only claim confidentiality for chemical identity—trade secret claims must be fully substantiated and non-frivolous and a highly ranked company official must sign the claim. The Environmental Protection Agency can impose strict penalties if these claims are shown to be false (United States 1988).

In most other national pollution release and transfer registers similar requirements are incorporated, which place the onus on reporters to provide evidence that their disclosure may cause industrial or commercial harm (OECD 1995b). In the establishment of pollution release and transfer registers there is a tendency for industry to request that data is aggregated to such a level that individual firms cannot be identified. Most inventories, however, have accepted that many of the benefits of the system would be lost if firms did not have the pressure of this disclosure on them.

#### ■ *The costs of establishing a pollution release and transfer register*

Given the simplicity of a pollution release and transfer register system, the administrative costs for the authorities are fairly low. There are also other costs to be borne in mind, such as the time companies spend gathering the required information and filling out the forms. The fact that a time and expense burden falls on firms, conforms to the polluter-pays principle, but is, nevertheless, one of the issues of concern to industry and should be minimised. The administrative burden for governments depends on the scope and complexity of the system and of the levels of checks and balances built in, but some indications and estimates of potential costs can be made.

The World Wildlife Fund (1994) has made some preliminary estimates of the minimum resources needed by national governments to establish a toxic chemical inventory. In a country with 1 200 facilities reporting waste streams and product stream data, with an average of eight chemicals each, it estimates the following figures:

- to establish the inventory using a system developed from scratch would require about two microcomputers and eight-nine person years; and

- to establish an inventory based on an international model and software would require two computers and five-six person years.

The estimate, therefore, is that a small team could establish an inventory with minimum resources in about one-two years.

The full Environmental Protection Agency toxic release inventory programme has a permanent staff of 65, with additional people employed seasonally for data entry. It costs the Environmental Protection Agency about \$19 million a year, which works out at about \$240 per reporting plant. The estimated time for respondents to fill in the returns is 50 hours; there are an average of 3,5 returns per facility, that is, an average of 175 hours per facility. In the UK the establishment of the chemical release inventory was substantially cheaper as it relied on information already provided by facilities. The start-up costs were about £250 000, with annual running costs estimated at £62 500 (McGlinchy 1995).

The Australian national pollution inventory process has estimated costs at A\$1,9 million for the inventory as a whole, with costs of A\$11 000 per facility for all the annual reports. The polluter-pays principle seems to have been accepted in South Africa by all parties, as one of the guiding principles of environmental management. In this light the argument can be advanced that reporters should contribute financially, on a *pro rata* basis, to the costs of an inventory. Other financing options, such as sharing the expense between provincial and national government, could also be explored. It does not appear that cost is too large an impediment, with most pollution release and transfer registers being fairly inexpensive and cost-effective.

## Conclusion

All indications are that it is useful and necessary to establish a pollution inventory of some type in South Africa, one which can be used for supporting environmental improvements by:

- setting priorities;
- for encouraging voluntary reduction measures;
- allowing the tracking of progress in pollution reduction;
- for supporting regulatory initiatives; and
- for supporting citizens' action and participation.

If a pollution release and transfer register is established, it makes sense to tailor it to the specific needs of the country and to use it to include as much useful information as is practical. Once an entire reporting system is being put in place, the marginal costs of gathering new information may be relatively small while the benefits of new information may be great.

In South Africa's new democracy the right-to-know aspects are particularly important. Not only are they important in and of themselves to ensure that environmental management is open and accountable, but the sense that all social and economic actors are responsible for the environmental costs of their actions is an important one to engender. Ensuring that environmental impacts are openly reported helps this process enormously, and is one of the active steps that the country can take in meeting the sustainable development imperatives of Agenda 21.

An inventory is only a part of a pollution control system, and only one aspect of developing an environmentally sound industrial base. Only a multi-pronged strategy will ultimately achieve the goals of sustainable development. Whatever this strategy finally includes, information will be an essential aspect of it. Again and again researchers working on this volume have come up against a blank wall of unavailable information. Sometimes there was reluctance or downright refusal from industries to divulge environmental information; sometimes it was the authorities who were reluctant—but often the information is simply not there. Information—that vital commodity of the 1990s and beyond—is in short supply and this is hampering the protection of that other increasingly vital commodity—our natural environmental resources.

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## chapter 6

# SMALL BUSINESS MANAGEMENT

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## A case study from the Western Cape automotive sector

Ann Coleman

### **Introduction**

Public concern about industry's impact on the environment is usually directed towards large companies. Less attention is given to the environmental performance of smaller-scale industry. Yet, cumulatively, the environmental effect of large numbers of dispersed small-scale sites of industrial activity may be highly significant and not readily controlled. Given that the South African government is now actively promoting small, medium and micro-sized enterprises (SMMES), it is pertinent that the potential environmental consequences of such activity be identified and policy options considered. This chapter seeks to make a contribution to this process by discussing the environmental management of SMMES in general, and by presenting the findings of a case study on environmental management of SMMES in the automotive service sector in the Western Cape.

Our first task is to define SMMES in the South African context and to discuss the policy environment in which they operate. This chapter then reviews current initiatives in small business development in South Africa, refers briefly to international experiences in the environmental management of small businesses and then moves on to look at the current regulatory system in South Africa. A case study of the automotive service sector is then presented. This research was conducted in order to assess the environmental experiences of a sample of SMME owners and managers. By generalising the conclusions from this case study and adopting lessons from the international experience, this chapter concludes by identifying a number of policy measures which should be considered in formulating an environmental management strategy for SMMES in South Africa.

### **Small business development in South Africa**

In the case study, the Small Business Development Centre (SBDC) definition of "small business" was used (see Box 1). Since the time of this definition, however, more complex definitions have been provided in the National Small Business Enabling Act (RSA 1995a). Clearly, SMMES include a wide spectrum of activities, different technologies, and a spectrum

**BOX 1 The SBDC's definition of SMMEs**

... [Q]uantitatively by the number of employees as shown below and, sometimes, by market share and capital investment:

- micro as having less than five workers;
- small as having less than 50 employees;
- medium as having between 50 and 200 employees.

... [Q]ualitatively by:

- a close link between management and ownership;
- independent decision-making;
- personalised management;
- entrepreneur/risk-taking behaviour.

*Prodder newsletter 1994*

of sophistication and competencies. There has been considerable political debate about the need to qualify SMMEs more precisely with a sector-specific definition which takes account of different industry characteristics, such as levels of skills and technological development, capital investment, market share and access to finance. In December 1995, revised criteria for qualification as an SMME were proposed in the draft National Small Business Enabling Act, differentiating between two groups of industry sectors. These conditions are summarised in Box 2.<sup>1</sup>

### **Qualitative criterion (compulsory)**

The enterprise must be privately, and independently owned or co-operatively owned and managed and must not form part of an enterprise which exceeds the quantitative criteria referred to, but may have more than one branch.

The proposed definition requires compulsory application of the qualitative criterion, and compliance with two of the three quantitative criteria.<sup>2</sup> An important distinction made by the qualitative criterion is the exclusion of what are termed "artificially created entities (branches/units) that comply with the quantitative definition, but in reality are controlled by larger enterprise". Thus, some franchisees, although themselves small business operators, may be excluded from specific SMME support measures on account of the franchiser's size.

At the smallest end of the scale, micro-enterprises are generally considered to represent the informal companies which operate without business licenses, formal premises, VAT registration or accounting procedures, including, for example, street traders. Many

<sup>1</sup> The National Small Business Enabling Act outlines the conditions in a schedule, and allows for them to be reviewed and amended by the Minister of Trade and Industry, by notice in the Government Gazette.

<sup>2</sup> It was assumed that some smaller enterprises, micro-enterprises in particular, may find it difficult to furnish information on asset value; hence this leeway (RSA 1995a).

**BOX 2 Definition of SMMEs proposed in the draft National Small Business Enabling Act**

<b>Quantitative criteria (a minimum of two to be satisfied)</b>				
<b>Sector</b>	<b>Size</b>	<b>Total annual turnover</b>	<b>Total asset value (fixed property excluded)</b>	<b>Total number employees full-time</b>
<b>Group A</b>				
Agriculture, forestry and fishing, transport, storage and communication, financing, insurance, real estate and business services, community, social and personal services	Medium	R15,0m	R3,0m	51-100
	Small	R2,5m	R0,5m	5-50
	Micro	R0,5m	R0,1m	1-4
<b>Group B</b>				
Mining and quarrying, manufacturing, electricity, gas and water, construction, wholesale and retail trade, catering and accommodation services	Medium	R25,0m	R5,0m	51-200
	Small	R5,0m	R1,0m	5-50
	Micro	R1,25m	R0,25m	1-4
<b>Qualitative criterion (compulsory)</b>				
"The enterprise must be privately, and independently owned or co-operatively owned and managed and must not form part of an enterprise which exceeds the qualitative criteria referred to, but may have more than one branch."				

micro-enterprises operate from home-bases or, depending on the type of operation, in industrial hives established by the SBDC. Micro-entrepreneurial activity is thought to be extensive, and the environmental impacts of such activities need to be considered.

At the other end of the scale, medium-sized enterprises could clearly include quite technologically sophisticated operations with characteristics more like those of large firms.

The inclusion of this upper threshold in the definition is intended to facilitate support for SMMES as they grow in size and sophistication (RSA 1995a).

### **Government policy**

Government proposals for facilitating small business development in South Africa have been presented in a white paper entitled "National strategy for the development and promotion of small business in South Africa" (RSA 1995b) (hereafter referred to as the small business white paper). The white paper was released in March 1995 and discussed extensively at a national conference in Durban shortly afterwards.

This policy document outlines a framework for the arrangement of support organisations whose various roles will be to provide finance; transfer information on commercial and technical issues; provide advice, training and education; and facilitate business linkage programmes. It is envisaged that these responsibilities will be taken up by non-governmental organisations, business organisations and the private sector, with limited direct involvement by government. However, the process of SMME development will be governed by the National Small Business Council (NSBC), consisting of elected and appointed small business representatives and experts. It is proposed that this council be empowered to negotiate with all government departments at all levels (national, provincial and local) about the impact of existing and proposed laws which are perceived to unduly inhibit the competitiveness of small businesses.

Government policy is intended principally to prioritise support for black advancement and marginalised groups such as women, disabled people and rural families. Thus, government seeks to address constraints which have prevented access of historically disadvantaged sectors to market opportunities and which have impeded their ability to grow and sustain operations in a competitive environment.

In support of government policy, local business service centres are being established as Section 21 (not for gain) companies to provide one or more core business services to SMMES, including provision of information and advice, consultancy, networking and exchange of experience. Local business service centres will be registered and their activities will be accredited by a coordinating body called Business Development Service (BUDS). BUDS's charter for local business service centres includes the principle that businesses should comply with legal requirements, including safety, health and environmental regulations, but specific environmental assistance would be considered a specialised service.

To date, support of local business service centres has been used by and for low-tech businesses such as catering, small-scale retail and building services, and it is acknowledged that a lack of local capacity in core technology constrains opportunities in manufacturing. BUDS has developed proposals for the establishment of manufacturing technology centres in different sectoral disciplines to provide technological support to small businesses. This concept must still be accepted by government, and funding and collaboration sought from local large manufacturing enterprises.

Presently there are foreign investors who are offering integrated financial and technical support packages to facilitate the development of local manufacturing. For example, Danish support is given through their business-to-business programme, which

facilitates joint ventures between Danish companies and emerging black-owned business enterprises in South Africa. The programme is described as providing technical assistance and some limited financial support, with a specific mechanism for covering the costs of environmental studies, occupational health improvements and environmental protection.

Government policy in general, however, lacks a comprehensive position on regulating and improving environmental management in SMMES. The small business white paper refers only to expectations of compliance with "reasonable health and safety standards", and targeted assistance for "SMMES in ecologically sensitive activities". However, based on proposals in the draft National Small Business Enabling Act, SMMES may be exempted from certain legislation which is deemed too inhibiting for them.

### **Organised labour**

There is a concern among trade unionists that small businesses tend to pay lower wages than large companies, that they fail to safeguard health and safety and that they are hostile to unionisation. SMME representatives, on the other hand, have historically expressed antagonism towards industrial councils, trade unions and the Department of Labour, who are seen to increase labour costs and impose administrative difficulties (RSA 1995b).

South African trade unions have been especially concerned with wages, benefits and general conditions of employment, as well as skills training and opportunities for advancement. They perceive their role "as a service which can ensure fair labour practices, independent of government and [the] taxpayer's money".<sup>3</sup> Worker health and safety is being given increasing attention by the unions, although they generally have had limited capacity to address broader environmental policy issues (see Magane *et al* in this volume).

### **The environmental management of SMMEs**

Worldwide, industry is under increasing pressure to reduce the negative environmental impacts of their operations. These impacts include the consequences of negligent safety standards, risks to employee and community health, polluting emissions from production processes and risks from waste materials, particularly hazardous wastes.

Developed industrialised countries have had to deal for longer with the consequences of environmental damage. This has necessitated costly remediation programmes while more stringent environmental control regulations, coupled with economic incentives, have been introduced to force or encourage industry to take greater responsibility for their environmental impacts and to phase out certain ecologically unacceptable products. Complying with these conditions has tended to increase production costs in these countries, forcing closure of some businesses or threatening the competitiveness of certain industrial activities in the global market. Some industries have responded by relocating subsidiaries to countries with lower environmental standards and, hence, production costs. However,

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<sup>3</sup> Personal communication from Western Cape NUMSA office.

more recently there has been growing pressure to harmonise environmental standards internationally and to introduce environmental criteria into international trade agreements to "level the playing field". These measures are supported in particular by those multinational companies which subscribe to the principles of "producer responsibility" and "duty of care"<sup>4</sup> and which can be held liable for environmental damage wherever it may occur. Environmental pressure has also been a stimulus for innovation in the identification and implementation of production processes and practices which avoid or minimise environmental risks and associated costs. In this way some companies have found ways to achieve competitive advantage through environmental improvements; other companies—or whole industries—have formed collaborative initiatives to address environmental problems, and governments have sought to develop new national policies for strategic technological development in a growing environmental protection industry.

Most published information about these achievements reflect large-scale industry initiatives in developed countries. SMMES are, however, generally more constrained in their ability to adopt new technologies and business practices due to limited financial resources for new investments and a lack of appropriate skills to implement the required technical and management changes. In the interest of supporting SMMES faced with environmental problems, technical assistance and advisory support programmes have been established in many countries, with costs subsidised by national governments or international support organisations such as the United Nations. The type of support made available includes:

- technical assistance programmes coordinated by government departments and university-based technology centres;
- provision of information and training by trade associations;
- provision of grants or low-interest loans for clean-up, innovative research and pollution control by small business development corporations;
- establishment of centralised waste treatment facilities providing better treatment for specific waste types, and facilitating economic material recovery;
- assistance with implementing environmental management systems; and
- the United Nations Conference on Trade and Development's programme, Empretec 21, which seeks to establish institutional support for SMMES at a centralised business support centre for "one-stop" training, information and consultancy services. The programme includes environmental businessmanagement and, as a principle, will not assist any activity or support any transfer of technology which is not considered to be environmentally sound.

India provides an interesting case study of an economy which relies extensively on its small-scale industrial sector, reportedly growing at 8-10% per year, from a current level which already contributes more than 45% of industrial output (Roberts 1995). However, enforcement of environmental regulations has not kept pace with small industry growth, and public opinion is now forcing closure orders against many small businesses blamed

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<sup>4</sup> One of the criteria for compliance with responsible care, a voluntary commitment to certain principles of environmental responsibility, promoted among chemical industry members.

for environmental pollution and public health risk. In response, national government has established a central pollution control board to function as the main coordinating environmental agency, and state pollution control boards with responsibility for on-the-ground enforcement of SMME environmental control measures. The pollution control strategy includes development of shared effluent treatment plants (with funding provided jointly by central and state government, industry and the World Bank), reduced import duty on pollution control equipment and training in environmental auditing and environmental management systems. Given the low level of technological skills, however, use of advanced pollution control systems is not considered appropriate. The National Productivity Council runs a programme which promotes waste minimisation in small-scale industries by means of demonstration programmes. One of these is the United Nations Industrial Development Organisation's demonstration of waste reduction methods in small industry. The National Productivity Institute also provides information on cost-effective methods of waste treatment and pollution control (Environmental Monitoring Group 1993).

### **The current situation in South Africa**

During the past few years there have been a variety of environmental projects directed at developing national strategies for various aspects of environmental management in South Africa. Under the new political dispensation new concepts for a national environmental management policy have been developed with broad-based public participation, and new environmental legislation is expected in the near future.

In the meantime there is a general lack of coordinated control of environmental issues. Those companies subjected to international pressure to comply with certain environmental standards are doing so, while larger-scale industry members generally tend to adopt fairly consistent environmental standards through a mixture of regulation and voluntary action. However, management of environmental conditions in smaller-scale companies remains the responsibility principally of government enforcement agencies. These are highly fragmented and generally weak. The current regulatory responsibilities are identified in Box 3.

### **Health and safety**

The occupational health and safety division of the Department of Labour has responsibility for ensuring compliance with national health and safety regulations.<sup>5</sup> The head of the Western Cape regional office acknowledged that they are aware of many cases of non-compliance, particularly by smaller companies, but that they do not have the resources to conduct regular inspections. The SBDC hives are legally exempt from compliance with the regulations, but may sometimes be inspected informally and problems brought to the attention of the SBDC authorities who are responsible for the conditions in the hives. Other

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<sup>5</sup> Regulations include the Occupational Safety and Health Act, asbestos regulations, lead regulations, regulations concerning the certificate of competency and regulations for hazardous chemical substances.

**BOX 3 Government responsibilities for environmental control of industry**

<b>Central government</b>
<b>Department of Water Affairs</b>
• <i>regulations governing water quality and waste disposal sites</i>
<b>Department of Health</b>
• <i>monitoring of occupational health</i>
<b>Department of Labour, occupational health and safety division</b>
• <i>compliance with the Occupational Health and Safety Act and related regulations governing occupational health and safety conditions</i>
<b>Department of Environmental Affairs and Tourism</b>
• <i>national environmental policies, guidelines, strategies, norms and standards</i>
• <i>international environmental matters</i>
• <i>national legislation</i>
• <i>guidelines for integrated environmental management, environmental impact assessments and resource economics</i>
• <i>environmental education, training and research</i>
• <i>meteorological services; and</i>
• <i>air pollution</i>
<b>Local authorities</b>
<b>Sewage department</b>
• <i>water supply, sewage treatment and storm water management</i>
<b>Solid waste department</b>
• <i>refuse collection, littering; and landfill site management</i>

industrial premises are only inspected at the request of the Workman's Compensation Commission, in cases where there has been an unacceptable number of accidents—and, therefore, claims on the fund—or when a complaint is made by an employee, trade union or member of the public. Hence, inspections tend to be made retrospectively. Most accidents reportedly involve heavy-duty equipment, with injury to limbs.

Safety conditions and the responsibilities of employers and employees in maintaining safe working practices have been legally defined for many years in the Machinery and Occupational Safety Act, No. 6 of 1983. This has been replaced more recently by the Occupational Health and Safety Act, No. 85 of 1993, which has been extended in scope with additional control measures for preventing work-related illness. These include medical check-ups, workplace environmental monitoring, compulsory training for all employees in health and safety and the establishment of a collective consultation process for health and safety issues. In mid-August 1995, new regulations for hazardous chemical substances were promulgated, requiring more extensive biological monitoring of employees exposed to specified hazardous chemicals. The local health authorities expect that companies which already have health monitoring programmes will be able to extend these as required, but acknowledge that small companies will have greater difficulty in accommodating the prescribed measures.

Monitoring of occupational health conditions is a joint responsibility of the departments of Health and Labour. The latter report, however, that, as this is a recent addition to its brief, it has limited experience in this field. It outsources some monitoring work to recognised occupational health authorities.

### **Waste management and pollution control**

At the time of the study, Western Cape local authorities comprised different municipalities and regional service councils or transitional metropolitan councils, each authority being empowered to promulgate by-laws governing sewage and solid waste management in the areas under their jurisdiction. There is evidence of considerable disparity in the standards and control systems which are applied in different areas. Consider the following comparisons between different authorities in the Cape metropolitan area:

- The Bellville municipality does not charge its industries for heavy metal contamination in industrial discharges to the municipal sewage treatment works;
- The Cape Town municipality monitors and charges registered heavy metal waste-generating industries, but penalties for illegal discharge have, until recently, been too low to encourage improved effluent management; and
- the Western Cape Transitional Metropolitan Council has a policy of enforcing compliance by means of rigorous monitoring and high penalties.

The *modus operandi* of different local authorities would appear to depend significantly on the mind-set and competence of the designated staff responsible for aspects of waste management. The sewage branch of the Cape Town municipality acknowledged that its by-laws are not strictly enforced. Most of its office work involves processing permit applications by new businesses for permission to discharge to the municipal sewer. Reportedly there is a backlog of about five years in inspecting these premises to verify the permit conditions. The municipality explains that it has a limited budget and staff, and that the remuneration levels do not attract qualified staff for the posts of pollution inspector. This is the person interacting most closely with industry members, but who often lacks the knowledge or experience to advise companies which seek advice on waste management issues. As a principle, local government authorities assert that their role is not "to act as consultants" to industry, and that they will only direct businesses to the appropriate consultants for advice.

In contrast, the pollution control officer for the Western Cape Transitional Metropolitan Council, has developed what he perceives to be a small, but well-qualified and experienced division for effluent monitoring and operation of the sewage treatment works. He indicated that he is willing to provide companies with general advice and guidance in improving their effluent management, although he is not authorised to provide comprehensive technical support, which is seen as the work of consultants. He described his policy as "fair, but strict" enforcement. For example, through negotiation a concession was granted to a company to discharge higher levels of one type of restricted contaminant, in return for the company's undertaking to eliminate one of the other restricted contaminants. Defaulting companies have been prosecuted successfully.

Since the new local government structures were set up after the 1996 local government elections, it has been agreed in principle that all local authorities in the Cape metropolitan area should standardise their effluent discharge conditions, although it is not clear which standards would be used and how enforcement would be effected. The pollution control officer for the Western Cape Transitional Metropolitan Council suggested that industry within the Cape Town municipality's borders would be "shocked" by the stricter regulations enforced by its by-laws. In the meanwhile, the existing facilities remain unchanged.

It should be noted that, unlike health and safety regulations, there are no legal provisions which exempt the SBDC hives from compliance with local by-laws. However, several draft regulations issued in terms of the Environment Conservation Act No. 73 of 1989 contain clauses referring to "sectoral differences" which "should be taken into account in enforcing compliance with prescribed standards". No one who was questioned about this provision could explain to whom and under what conditions it would apply.

There are also serious environmental problems with the collection and disposal of solid waste and hazardous liquid wastes. There are vast quantities of solid waste which must be collected, including that from households, commercial and industrial premises, as well as litter and other discarded materials. Littering and dumping are particularly serious problems in areas of informal trading and in areas which lack appropriate waste collection facilities. This is one of many problems faced by the municipal cleansing departments who are under great pressure to develop innovative solutions for urban waste management in collaboration with business and the public.<sup>6</sup>

Other, more insidious, wastes are those hazardous wastes generated by small businesses (sometimes referred to as small quantity generators) who lack the appropriate knowledge or interest to manage their wastes effectively. Typical small quantity generators include academic and commercial research laboratories, laundries, automobile service facilities, municipal government, building contractors, paint manufacturers, pest exterminators, funeral services, photographic processors, garden centres, plumbers, tanneries and swimming-pool chemical suppliers. It is known that some of these wastes are being dumped illegally, for example, drums of solvent waste removed from businesses by private contractors for a small fee, with "no questions asked". Such wastes should be disposed of at registered hazardous waste landfill sites, but even domestic landfill sites may receive mixed wastes contaminated by hazardous constituents.

Many landfill sites do not comply with what are considered minimum acceptable standards of environmental control. There is particular concern about contamination of surface and groundwater by run-off and leachate from landfill sites (see Goldblatt in this volume). In some areas, the Department of Water Affairs and Forestry is forcing closure of polluting sites. There is ongoing conflict about the location of new sites, resulting in an expected shortfall of disposal capacity, with serious environmental consequences.

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<sup>6</sup> Presently in the Western Cape there is an initiative which seeks to drive the provincial government towards developing an *Integrated Waste Management* policy and strategy for the whole province. Members involved in this initiative include local government, the regional department of water affairs, health officials, academics, NGOs, community groups, the public and industry.

Given the reality of these problems in waste management in the Western Cape, it seems inexplicable that proposals for a sustainable development path for the Cape municipal area (City planner's Department 1993) have neglected to consider infrastructural requirements for the management of waste and pollution generated by industry, as well as increased domestic and commercial waste. This situation is symptomatic of a lack of collaboration and cooperation between different local government departments and a lack of authority given to environmental practitioners. The lack of appropriate and safe waste management facilities is a constraint on economic activity.

Nationally there are similar problems of waste and pollution control, but local authorities in other provinces may have different strategies for addressing specific problems to accommodate local industry characteristics and other regional conditions. In Durban, for example, metal plating companies have reportedly been requested to undertake greater responsibility for the treatment of their effluents, so that the limited capacity and resources of the local municipal facilities can be used for other industrial effluents.<sup>7</sup> Again, there appears to be very little collaboration nationally between different local authorities, by way of exchange of information and benchmarking against others' activities.

Air pollution control is a responsibility which was transferred from the Department of Health to the Department of Environmental Affairs and Tourism in April 1995. Due to a lack of departmental resources at a regional level, this function is presently centralised in Pretoria and there is no regular regional control programme. Proposals for allocation of regional functions are reportedly being developed.<sup>8</sup>

### **The significance of environmental concerns for SMME development**

SMMEs and environmental conditions cannot be isolated from environmental issues affecting industry and manufacturing as a whole. Environmental pressures will affect all sectors of industry to a greater or lesser extent. What needs to be considered is the ability of SMMEs to respond effectively to these pressures.

The case study which follows seeks to ascertain the perception of environmental problems and the issues identified above by various role-players involved with small business activity. The industry perspective is specific to the automotive service sector although, to some extent, it will be possible to extrapolate the findings to SMMEs in general.

### **Case study: SMMEs in the automotive service sector**

This sector was selected for the following reasons:

- its contribution to numerous employment opportunities;
- the wide spectrum of activities by small and medium-sized businesses;
- the variety of inert and hazardous waste generated by this sector;

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<sup>7</sup> Source: news release by Toyota Corporation explaining why the expertise of their Japanese holding company was being used to improve their onsite effluent treatment capabilities.

<sup>8</sup> Source: Western Cape Directorate of Environmental Affairs.

- the similarity of activities and waste types in different areas in South Africa;
- the perceived environmental impacts associated with these activities and waste types; and
- the availability of literature on these environmental issues;

Input to this study has been provided by site visits, interviews with company management and employees (where permitted), as well as discussions with representatives of trade associations, business support organisations and trade unions. The objectives were to assess actual conditions at different local business premises and the perceptions of environmental problems by various role-players in the industry.

The study focused on the situation in the Cape metropolitan area and was directed principally at formal small business operators. Although informal activity is extensive, it was difficult to obtain access to informal businesses such as those operating at the SBDC hives and in township areas.

### **Description of the industry**

Automotive service activities encompass sales, service and repairs of automobiles, parts and accessories, as well as sale of fuel. In each area of service there are operators ranging from micro-operators to the high end of small-scale operators, and from street-corner booths to modern, high-tech workshops and display showrooms. There are an estimated 40 000 people formally employed (that is, registered with the industrial council) in such activities in the Western Cape,<sup>9</sup> making this sector a large employer. The extent of employment in the informal sector is not known, but can reasonably be assumed to be significant, given the large numbers of small businesses in the SBDC hives and township areas.

Primary automotive engineering is not a feature of Western Cape industry, although there is some component manufacturing for the after-market—for example, shock absorbers and radiator cores. These were included in the sample for two reasons: firstly, these businesses are typically medium-scale, with more sophisticated technology and management systems than many of the small service businesses (some are producing for the export market) and, secondly, there is a conflict of interests between the manufacturers and retailers of new components and the component reconditioners. These issues are discussed in more detail below.

Another commercial activity associated with the automotive trade is the processing of vehicle scrap for material recovery. Although most material is handled in large scrap yards equipped with the appropriate facilities, some small-scale and informal waste recycling takes place and such activities are increasingly being promoted as job opportunities.

The ownership of businesses in our sample can be divided into three groups: franchises, subsidiaries and independent operators. In terms of the proposed definition of SMMEs given in the draft National Small Business Enabling Act, franchises and subsidiaries

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<sup>9</sup> Source: Motor Industries Federation

may not be categorised as SMMEs if they are controlled by large enterprises. However, franchisees probably consider themselves small business owners.

Franchises are most common for service stations, new car dealerships and retail outlets for parts and accessories. Franchise opportunities are, however, emerging for businesses in the more technical areas of component servicing and repair, such as radiator repair. Franchisees are usually minority shareholders in the business. The franchising company provides technical and marketing support and the advantage of group advertising, while the franchisee is expected to comply with certain prescribed business conditions which are intended to protect the franchiser's interests and reputation. Environmental auditing and incentives are not yet common practice in franchising arrangements, even though the controlling company—for example, the auto manufacturers or oil companies—may use such systems at their large production sites.

Independent, privately owned operators are more typical in the retail of second-hand cars and in repair and reconditioning activities, where businesses are often family-owned and managed. These types of businesses show the greatest variation in business practices. Some businesses are efficiently managed and duly accredited by the various institutional authorities, for example, the Motor Industries Federation (MIF) or the Automobile Association (AA). Others appear to be more haphazard, but may be faring well commercially because of the individual skills of the owner.

Commercial activity in automotive servicing is described as being highly competitive and information is not readily shared between companies. There does appear to be some informal networking for exchange of information, but only where there are no obvious competitive gains or losses.

There are 11 trade associations which represent automotive service sector activities. Collectively these make up the MIF, which provides an umbrella organisation and a channel of communication to government, the automobile manufacturers and to trade unions. By collectively representing 54% of formal sector business operators in the Western Cape, the MIF acts as a powerful lobbying body for its members.

The MIF does not have a prescribed environmental code of practice, but does from time to time arrange seminars to address issues such as occupational health and safety.

Some member companies interviewed for the case study expressed disenchantment with the type of support given by the MIF, which is perceived to be colluding with big business and labour to the disadvantage of smaller member companies. This situation may partly be a consequence of the lack of capacity of smaller companies to participate actively in organisational roles outside their own business commitments, not having the time, resources and/or inclination to do so.

The role of the South African Motor Industries Employers' Association (SAMIEA) is to represent the interest of employers in collective bargaining and industrial relations. SAMIEA membership in the Western Cape is reported to be 61% of formally registered businesses, covering 85% of employees in the formal automotive service sector. Employees of SAMIEA members are members of one of the following three trade unions:

- the Motor Industry Employees' Union for journeymen, that is, qualified artisans;
- the Motor Industry Staff Association for clerical staff; and
- the National Union of Metalworkers of South Africa (NUMSA), a Cosatu affiliate.

Given the lowering of import tariffs in the industry, and the opening up of the sector to increased global competition, it is likely that rationalisation will occur in most areas of the formal automotive industry. Service companies will reposition themselves to remain competitive or to increase their profitability through changing their service profile. For example, there will be fewer models of different makes of cars available on the market, as models with low sale units will be penalised. To counteract shrinking car sales, franchised dealerships expect to change from sole to dual franchise agreements so that they can market more than one make of vehicle, and extend their in-house vehicle maintenance services to different makes of vehicles. Preventative maintenance will become more specialised for high-priced and technologically sophisticated vehicles. The challenge for SMME service providers will be to remain technologically competent. The larger businesses have the advantage of resources for ongoing in-house technical training, which SMMES often lack.

Some managers of service and repair businesses referred to the potential for "auto cities" to be established as centralised service centres which incorporate one of each type of service provider in a dedicated facility. This is perceived to have the competitive advantage of being able to offer the customer the convenience of all vehicle-related service requirements in one location. Each business involved would be expected to maintain a high standard of service in the interest of all the participating businesses. The variety of automotive service businesses operating at some SBDC hives already provide the basis for such a centralised service concept, conveniently close to the townships.

Manufacturers and retailers expect a smaller product range of many locally manufactured goods with the emergence of fewer, larger companies, with greater economies of scale, to compete with imported goods. For example, imported tyres are expected to increase from about 12-15% of local sales, to 40%, with local manufacturing shrinking.<sup>10</sup> Cheaper, imported components will also reduce demand for reconditioned components, which will threaten existing reconditioning businesses.

### **Environmental considerations**

The automotive servicing sector is part of a much larger industry which supports a broad spectrum of vested interests in automobile use. The debate about environmental responsibility in this sector is clearly related to broader transportation issues. These include energy and resource consumption and the pollution effects of existing transportation systems, especially widespread private vehicle usage. Addressing these concerns may, in the long-term, change the profile of environmental concerns. However, the main purpose of this case study has been to concentrate on the short and medium-term environmental concerns in the industry. On this basis the problems which were considered include:

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<sup>10</sup> source: TDA chairman

- health problems caused by exposure to hazardous materials;
- emissions of volatile organic compounds from the workplace as a health hazard and a source of air pollution;
- safety problems caused by the handling of hazardous materials and high-risk equipment;
- run-off of motor oil into sewers or storm-water drains;
- impacts from waste disposal and illegal dumping of wastes; and potential soil and groundwater contamination by hazardous constituents in the discarded wastes.

Most business owners or managers claimed to be aware of the common safety concerns relating to the use of pneumatic equipment and heavy-duty machinery, use and storage of flammable liquids, welding and soldering and use of pressurised vessels. They also claimed to be familiar with the regulations governing safe working practices. Some of the managers admitted that conditions are not always as they should be, but the blame was generally put on employees for not following prescribed procedures or for neglecting to use protective equipment properly.

All the companies engaged in activities involving exposure to lead and asbestos claimed to comply with the asbestos and lead regulations (promulgated in 1987 and 1991 respectively). These prescribe maximum permitted exposure limits for these substances, control conditions—for example, ventilation and dust extraction—and occupational hygiene programmes—for example, blood sampling for lead analyses.

The more extensive and rigorous regulations prescribed by the Occupational Health and Safety Act are generally perceived to be too onerous for small businesses.<sup>11</sup> Some managers admitted that they do not comply with some of the requirements, particularly those related to supervision, training and education and functioning of health and safety committees. The following are examples of specific responses:

- Most of the business owners or managers who were interviewed were not willing to allow their actual premises to be assessed. The owner of a small radiator repair business admitted to concern about liability.<sup>12</sup> He explained that he conducted weekly informal discussions about health and safety issues, and that lead monitoring was undertaken by a private doctor on a contract basis.
- Another radiator repair shop (a franchise operation) had likewise contracted a doctor privately to do the necessary lead monitoring, but there was no on-site health and safety awareness programme. He reported that the parent company was in the process of organising a groupwide health monitoring programme which would be made available to all member companies.

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<sup>11</sup> These regulations place greater liability on company management for ensuring that prescribed safety conditions are complied with and extend management responsibility to occupational health. Responsibilities include environmental monitoring, biological screening of employees and the establishment of formal health and safety departments.

<sup>12</sup> Based on a superficial sighting of activities on these premises, conditions clearly were quite haphazard and would not be in compliance with regulations governing work place conditions.

- A respondent who had recently taken over a company engaged in panel-beating claimed that he wanted to improve site conditions but did not know how to go about this. He allowed his premises to be inspected and staff to be interviewed. The site was quite well-organised, although there were unsatisfactory conditions such as a lack of bunding around the oil storage tank to prevent spills. There were no health and safety representatives.
- The factory manager of a company manufacturing radiator cores also allowed his site to be reviewed. The business had recently relocated to newly constructed premises which, consequently, were modern and well-organised. New structures for health and safety committees had been established. In this case, health and safety representatives received National Occupational Safety Association training and staff members were clearly better informed about environmental issues. One of the site problems which had been identified was inadequate ventilation in one of the areas where lead was used. Management, however, did not consider changes to the ventilation system to be affordable at the time. Lead monitoring was undertaken by a private doctor on contract.
- The factory manager of a medium-sized component reconditioner reported that their factory conditions were monitored regularly by a private company of occupational hygienists under contract to the occupational health division of the Department of Labour, and they contracted out staff training to a commercial company.

At the time of questioning none of the interviewees was aware of the new regulations for hazardous chemical substances, which include volatile organic compounds contained in solvents and isocyanates in spray-paints.<sup>13</sup> Exposure can be minimised by using effective extraction systems and appropriate breathing apparatus in spray-painting areas, but this type of protection is clearly lacking at many small service facilities.

The low priority given to occupational health and safety is reflected in the lack of knowledge imparted to technicians in training. The chairman of the panel-beater's trade association reported that subjects covering the hazards of spray-painting, health and safety issues and personal protective equipment "are being considered" for incorporation in the modular training programme which is being developed for technicians in the motor body repair trade.

Primary sources of pollution are direct emissions during servicing, such as volatile organic compounds, and waste materials which are discarded. In some countries there are strict regulations governing volatile organic compounds emissions or at least proposed strategies for reducing such emissions.<sup>14</sup> There are also visible problems caused by improper waste management. Table 1 identifies the types, sources and characteristics of typical wastes generated by automotive service activities.

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<sup>13</sup> The Department of Community Health at the University of Cape Town has initiated a research project to investigate the prevalence of illness caused by isocyanates, thought to be carcinogenic, to workers employed in spray-painting. No results are available yet, but USA research reportedly indicates that it may be significant.

<sup>14</sup> For example, an EC directive targets industry sectors which use organic solvents, including car manufacture and damage repair businesses.

**TABLE 1** Profile of wastes generated from automotive servicing

Waste type	Operational source	Source by industry activity	Waste characteristics
<b>Organic:</b> spent solvents and sludge residue e.g. paint	parts cleaning, spray-painting, and engine cleaning	spray-painters, and engine servicing	volatile organic compound emissions toxic (may contain 100 parts per million to several thousand parts per million chlorinated solvent components) potentially flammable
<b>Aqueous:</b> wash water and flush water	car cleaning and water testing of radiators	service stations and repair shops which wash cars typically contaminated with detergent, solvents, oil, heavy metals	
<b>Oily:</b> engine oils, hydraulic oils and sludge residue	Engine cleaning and maintenance, engine servicing		potentially high concentrations of hazardous heavy metals (e.g., cadmium, chromium, argon, barium, zinc, lead) may also contain chlorinated solvent components as a result of mixing of wastes
<b>Acids/alkalis:</b> carburettor cleaner and caustic cleaning solutions	Engine cleaning and maintenance	engine servicing	corrosive - may be contaminated with lead
<b>Other liquids:</b> anti-freeze, and transmission fluids	Engine cleaning and maintenance	engine servicing	corrosive toxic
<b>Solids:</b> batteries, acid, tyres, steel and non-ferrous scrap, brake shoes and shock absorbers, bumpers, glass and textile residues, and maintenance wastes in workshops, e.g., filter media from extraction systems <sup>2</sup>			combustible recyclable, contain asbestos and heavy metals <sup>1</sup> limited recyclability

**Note**

<sup>1</sup> These hazardous materials are fixated in the automotive components and would be effectively inert as a waste, but are a source of hazard during manufacturing or reconditioning.

<sup>2</sup> If non-hazardous wastes are mixed with hazardous wastes, the waste is rendered hazardous, for example, sawdust used as an absorbent to clean up oil spills.

Local authorities consider storm water contamination by oil, solvents and contaminated aqueous effluent to be the most critical pollution problem, resulting in contamination of rivers, marine environments and aquifers to which storm water is discharged. Presently local authorities have no system for containing this contamination, except to discourage illegal discharges to the storm water system by issuing spot fines if an offence is detected.

Most of the interviewees acknowledged that they are sometimes guilty of allowing run-off of contaminated water into the storm water drains through careless practice. The fines are considered too low to be an effective deterrent. Some service station courtyards and workshops are not sloped correctly to contain oil spills or oil-contaminated wash water, or to divert this waste to oil traps. At one of the radiator repair sites lead waste had been dumped in the yard next to a storm water drain. On the day of a visit to the Blackheath SBDC hive the storm water channels in the yard were flowing with dirty water. This could possibly have come from one or more of the mini-factories used for automotive repair work.

The discard of waste engine oil is also considered a significant source of potential soil and groundwater contamination. Under pressure to address environmental problems associated with the processing and use of oil products, members of the oil-refining industry in South Africa have established an organisation known as the Rose Foundation to promote duty of care in the industry. One of its activities is the coordination of a nationwide oil collection service for waste lubricating oil which can be re-refined. Oil is collected from individual premises, bulked at a centralised facility and transported in tankers to a re-refining facility at Krugersdorp. The processing operation itself has, however, experienced serious environmental problems and may be forced to close. The chairperson of the Rose Foundation was unwilling to discuss the situation during the course of this study, but he explained that they were seeking to develop more environmentally acceptable re-refining processing technology. However, any such venture had to be able to compete commercially with other processors which may operate with a lower standard of environmental controls and overhead costs.

Most of the interviewees were aware of and made use of this oil collection service which pays for the waste lubricating oil, and which removes diesel and paraffin mixtures as a service, but without payment. There are also other local companies which collect mixed oily wastes for processing into fuel, but there are also reported cases of pollution problems from these sites as a result of mismanagement of oil spills. Oily sludge and oil-contaminated effluent from on-site fixed storage facilities are periodically removed by waste contractors for treatment or disposal at a landfill site.

Another source of oil pollution is petrol leakage from underground storage tanks at service stations.<sup>15</sup> The installation, repair and maintenance of these tanks is the responsibility of the oil company to which a service station is licensed. Reportedly a new

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<sup>15</sup> Fuel losses are detected by daily checks on sales and inventory.

South African Bureau of Standards standard has been developed with specifications for double-lined tanks with leak detection systems. It is expected that these tanks will be installed at new service stations, but there is no strong pressure or collective industry policy to force existing installations to be upgraded.<sup>16</sup>

Solvent recycling is less well-established than oil recycling, although there are some local commercial solvent recyclers, and small-scale distillation units are available commercially for on-site applications. One of the companies which was reviewed uses such a unit to recycle thinners. However, most of the spray-painting businesses were disinterested in such recycling for one or more of a number of reasons: it was not considered to be economically attractive, it was potentially unsafe, or it was a bothersome extra task. Instead, some company managers or the staff admitted that they discarded waste solvents to the sewer, poured it on the ground or mixed it with their waste oils. In one case the manager professed ignorance to the fate of this waste. Others reported that they paid a private contractor to remove full drums of solvent, with "no questions asked". This waste is often dumped illegally. Some companies reported use of formal waste contracting services for disposal at authorised landfill sites. Clearly, there is a high level of mismanagement of solvent wastes.

In addition to oil contamination, effluent from radiator component manufacturers and repair shops may contain significant heavy metal contamination. There are well-established chemical and physical treatment processes for removal of heavy metals, but few of the companies had the proper facilities for pre-treating their effluent effectively. Moreover, with one exception, none of the managers understood the principles of the by-laws governing effluent from their premises. Even though they perceived the penalties for transgressions to be high, there was not sufficient inducement to improve effluent management themselves on-site.

However, one factory manager reported that he had been assisted by the pollution control department in the Cape metropolitan area in developing a new on-site effluent treatment plant and had been advised about the penalties which would be incurred for the discharge of poorly treated effluent to the sewer system. The high penalties rendered on-site chemical treatment economically attractive. This company clearly had the advantage of being able to incorporate the appropriate facilities at the start of operation. Retrofitting of new process plant for pollution control and waste treatment into an existing operation, is more complicated and usually much more costly.

Despite the fact that effluent problems are common, there is no evidence of technical assistance being made available by franchisers to their franchisees, unlike the group response to implementing health and safety programmes in compliance with the Occupational Health and Safety Act. There is also no evidence of collaboration between similar business operators in trying to resolve these problems. Some of the interviewees agreed on the benefit of such collaboration, but suggested that competitiveness between

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<sup>16</sup> Source: Caltex environmental specialist.

different companies would preclude this as businesses were unwilling to share information. One of the business owners conceded that there was potential to optimise his existing process, with savings from improved environmental control, but he was unwilling to change the basic process with which he and his employees were familiar. This reflects both a lack of technological capacity and low level of environmental responsibility at all levels of business.

### **Recycling and reconditioning**

Much of the solid waste comprises scrapped automotive components. These may be recycled to recover component materials, reconditioned or discarded either by illegal dumping or authorised disposal to landfill.

Material recycling is well-established for those materials which have value as raw materials, for example, steel, copper, brass, zinc and lead. Most foundries own scrapyards so as to secure supplies of ferrous (iron) and non-ferrous (copper, brass, zinc) feedstock, with automotive scrap being a major source of material. Scrap is purchased from government, industry, small-scale waste merchants and informal traders. After fragmentation and magnetic separation of ferrous and non-ferrous material, ferrous material can be smelted locally, while most non-ferrous material is transported to Gauteng for smelting. In the separation process, lightweight residue material comprising rubber, cloth, glass and plastic is extracted via a cyclone system and discarded to landfill.

The manager of a battery retailer reported that battery recycling is at a high level in South Africa as a consequence of a refundable deposit of R8,50, included in the scrap value of batteries.<sup>17</sup> Old and new batteries are exchanged on a one—for—one basis between consumers and retailers and between retailers and manufacturing wholesalers who return stocks of old batteries to a company in Gauteng for recycling. The acid may be treated for reuse or disposal, battery cases are pulverised to recover plastic granulate for recycling and lead is re-refined. Batteries contained in scrapped motor vehicles escape this material recycle as dealers do not pay when there is no sale to balance the books. So, batteries have no value for scrap dealers. One scrap dealer explained that he decanted the acid into drums, used the acid for floor-cleaning, and gave the battery cases to anyone interested in recovering the lead—to make fishing sinkers, for example!

In the formal sector battery reconditioning is not considered viable compared with the economy of scale of manufacturers equipped to produce thousands of new batteries daily. There are reportedly some small informal operators who either recharge batteries with new acid content, or rebuild batteries. This involves breaking the cases, smelting the lead to make new plates and refilling with fresh acid—a labour-intensive process.

Plastic bumpers may be re-granulated and incorporated in the manufacturing of recycled plastic products such as Polywood (plastic wood), but only limited quantities of this hard plastic can practically be used. Alternatively, there are about five companies in

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<sup>17</sup> This was an inducement for the return of old batteries, introduced at the time of World War II because of the strategic value of lead, and retained in South Africa.. Elsewhere, for example, in the USA, where no such inducement is made, disposal of batteries is a serious environmental problem.

the Western Cape which restore plastic bumpers using a welding process. This market niche is considered to be saturated.

Some material recycling of tyre rubber does take place, for example, to produce a rubber granulate used for road surfacing and some small-scale production of products such as mats and shoes. Some tyres find reuse as stabilisers in soil embankments or as artificial reefs. Burning of tyres as a fuel substitute in cement kilns has also been proposed by the cement manufacturing industry. However, while technically possible, large-scale tyre recycling is constrained by logistical problems and operating costs associated with collecting discarded tyres and dumping or landfill disposal of tyres remains common practice with its attendant environmental problems.<sup>18</sup>

A tyre and rubber recycling committee has been formed by the manufacturers, retailers, retreaders and the MIF to find solutions to the tyre disposal problem. Among proposals made to the committee by a cement manufacturer is the addition of a levy on the price of tyres, funds from which could be used to finance the establishment and operation of small businesses for the collection and transport of tyres to the cement kilns. Certain members of the tyre industry, however, resist imposition of any additional cost for this purpose on the retail price of tyres, for a complexity of reasons. These include the unwillingness of local manufacturers to take responsibility for imported tyres, the unwillingness of tyre retreaders to contribute to the costs of tyre collection and recycling on the grounds that they already provide a solution by extending the life of tyres which would otherwise become waste. Manufacturers have yet to agree on an industrial response, but are under increasing government pressure to do so.

In those industrial sectors where recycling of certain materials does take place, it points to the environmental responsibility of the sector. At the same time the business sector admits that such activity does not take place unless it is commercially viable. For example, lead recycling is threatened by a drop in lead prices. Recycling which has been successful to date uses a refundable deposit on the value of the material as an incentive for consumers to return goods for recycling. Low prices for new components have also detracted from the relative value of recyclable components. For example, the core deposit paid as an incentive for the return of clutch components was reduced from R20 to R5 during the latter half of 1995. This, in turn, reduces the income of collectors of such components and increases the discard of material to waste.

Other solid waste components are usually disposed of through normal municipal waste or in rented skips and removed by municipal services. Potentially hazardous wastes may also be discarded in this way—for example, oil and paint containers—thereby contaminating what would otherwise be inert waste material. This raises concerns about the potential for pollution from domestic landfill sites which are not designed to contain hazardous wastes, and therefore is a health risk to persons who may scavenge from the waste bins and skips.

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<sup>18</sup> Tyres consume significant space in landfill, are difficult to compact and, therefore, tend to move, and are combustible. There is also increasing awareness of the problem of tyre burning in the township and squatter areas for the purpose of recovering the steel for sale as scrap. The value of this is reputed to be about 40 cents per tyre.

### Response to environmental pressures

Internationally there is pressure on the automotive sector as a whole to address its major environmental impacts, including risks from processing fuel and fuel storage; huge infrastructure requirements for widespread private vehicle use; energy consumption; air pollution by vehicle exhaust gases; and disposal of discarded vehicles and components. Compared with these impacts, those of manufacturing and servicing seem insignificant. However, in the hazardous waste management field, automotive repair activities are considered to be the greatest source of hazardous waste by small quantity generators. It is one of the industrial sectors which has been targeted by federal and state pollution prevention programmes in the USA, which seek to assist companies to improve their waste management practices and to comply, cost-effectively, with federal and state regulations. The emphasis in the USA experience has been on waste minimisation.

Stricter legislation governing manufacture and use of some hazardous materials, including oils and solvents, has been introduced in some countries. German law includes limits on the toxicity of materials such as mineral oils while, in Sweden, "producer responsibility" compels producers to develop less harmful alternatives to hazardous materials. Water-based paints have been developed as an alternative to spray-painting with solvent-based paints, requiring, in addition, new technology for paint application. More efficient technologies for application of solvent-based paints have also been developed, with reduced emissions and wastage, coupled with the recovery of solvents. A carbon fibre or glass fibre alternative is available for asbestos, another hazardous material, used in car brake linings.

The large-scale problem of discarded automotive scrap is being addressed by different national governments through specific policy measures directed at enforcing or encouraging greater material recycling in the automotive industry. For example, Japan, Germany and Sweden have introduced specific legislation which prescribes conditions relating to:

- producer responsibility for wastes associated with automotive manufacture;
- use of recyclable materials in vehicles;
- identification of plastics to facilitate separation for recycling;
- compulsory return of vehicles to manufacturers or dealers; and
- dissemination of information about recycling.

As a result, vehicle disassembly and salvaging operations have increased in some countries. Le Roy (1991) reviews initiatives by automobile manufacturers in France where a collection network and centralised reclamation centres have been established for the recovery of precious metals in catalyst, exhaust pipes, battery lead, solvents and polypropylene from bumpers and battery cases, as well as treatment of waste battery acid and waste oils. In Italy, Fiat has introduced the Fiat auto recycling system for recycling of scrapped cars.<sup>19</sup> This comprises a national network of demolition firms which disassemble and remove

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<sup>19</sup> Source: Engineering News and information forwarded by Nissan's marketing division.

plastic components, seat foams, glazing, catalytic converters, carpets and chloro-fluorocarbons (CFCs) from air conditioners. This material is reused in other cars or directed to other markets. These initiatives demonstrate the benefits that material recycling has a) for its contribution to the supply of raw material, b) the economic value of activities, in recovery and reconditioning of used components and c) reprocessing of materials from scrap.

There is also evidence of technological developments which can extend the life of worn components. For example, Jackson (1993) makes reference to a novel, low-temperature vacuum retreading process for vehicle tyres which allowed a \$500 truck tyre to be retreaded for \$175, giving a further 65 000 miles of life. However, the market for retreadable tyre casings in South Africa has declined because of low-cost imported tyres. Jackson (1993) also refers to "early estimates of product life extension in the vehicle industry which suggest that the use of improved corrosion-resistant materials, appropriate assembly methods and periodic maintenance could double the useful life of the vehicle with only a minor (10%) cost increase".

Most of the interviewees expressed broad-based concern about problems of environmental quality, but admitted that environmental concern is largely given lip service because no competitive advantage in substantive action is perceived. They did not believe that the general public has the level of environmental awareness or sophistication to pressurise industry for more environmentally defendable actions. One business manager suggested that some aspects of environmental concern were inflated in the interests of creating a demand for environmental services. He felt that control should not be prescriptive, but conditions were needed which would be an incentive for companies to improve environmental conditions. In particular, he argued for more information to be made available both to industry and to the consumer. Industries could then position themselves strategically and the public could drive initiatives by making appropriate environmentally-based decisions. Only then would companies benefit from marketing their goods on environmental grounds.

Presently, regulation is seen as the primary inducement action to improve environmental conditions. However, few of the businesses respect existing environmental legislation, which is perceived to be too complicated and weakly enforced. Furthermore, almost all the interviewees were resistant to any measure which would potentially increase production costs. One business owner did, however, refer to the higher environmental standards in Japan, where industry, nonetheless, is able to remain competitive because of high productivity. Against the broader trend, one trade association chairperson supported the concept of stricter regulatory control, as he believed in the need to pay a higher price for a cleaner environment. He suggested that smaller businesses which could not afford higher costs should perhaps be subsidised in the interests of job protection.

None of the interviewees had any experience with the principles of waste minimisation and, in general, were disinterested in the potential to effect production cost savings. This lack of interest can be attributed to many reasons, one of which is the low priority given to environmental performance. Consequently, there has been no motivation to implement technological improvements for environmental benefits.

Only two of the interviewees identified technology changes in response to environmental concerns. One was the substitution of CFCs as a refrigerant in automotive cooling systems; the other was the introduction of new water-based paints. One business owner in the spray-painting trade reported that they were experiencing problems with some imported cars which had water-based coatings, which rusted their spray-painting equipment. He suggested that only the larger shops would be able to afford to invest in new spray-painting technology.<sup>20</sup>

Most of the interviewees supported the principle of recycling which provided opportunities for people to earn a living, referring principally to informal collectors. The plant manager of a component manufacturing company supported the concept of recovery of material for recycling as feedstock, with benefits in job creation, but opposed manufacturing activities which would reduce profitable turnover of new products. He argued that high labour costs render repair and reconditioning more expensive than replacement with new goods, which are also more convenient for the consumer.

Only one of the interviewees, whose company manufactured components, was interested in the export market. He felt that environmentally-based trade constraints would apply only to original equipment, and not to components for the after-market or reconditioned components.

### **Lessons for the environmental management of SMMEs**

The preceding case study has highlighted some of the short and medium-term environmental and occupational health and safety issues relevant to the automotive service sector. Extrapolating the findings, reasons for the apparent incapacity of small businesses in general to respond effectively to environmental pressures may be summarised as follows:

- Regulatory enforcement is ineffective due to the lack of the resources of regulatory authorities to carry out their responsibilities timeously, and the costly system of monitoring and enforcement.
- Market conditions do not encourage self-regulation or collaboration between different companies to address common problems.
- Many SMMEs do not have appropriate skills or the experience to address environmental problems. Typically there is a:
  - lack of awareness of global trends in legislation and technological alternatives for improving environmental performance;
  - lack of knowledge about the environmental hazards of certain materials;
  - lack of insight into the causes of, and potential solutions to, waste problems;
  - resistance to more sophisticated technology and increased skills requirements; and

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<sup>20</sup> Water-based paints will generate an aqueous effluent rather than a solvent waste, which could become a more difficult waste to treat. An alternative is the use of more efficient spraying systems and recovery systems for solvent-based paints.

reliance on off-site waste processing facilities and neglect of in-house responsibility for addressing waste related problems.

- SMMES have reduced economies of scale with lower production capacities. Consequently, they have less financial resources for capital investment, and are less able to meet recurrent costs.
- There is no effective infrastructure for the dissemination of information and for technology transfer.

There are few coordinated services such as specialist waste collection and recycling.

- There is limited institutional support from, for example, trade associations.
- There is limited commercial interest from environmental consultants who focus on large industries.
- There has been limited commercial interest from equipment suppliers for small-scale process development, due to a historical lack of demand. Hence, there are technological few options currently available on the local market.
- Seminars, training programmes and expert assistance are often too costly and time-consuming.

These difficulties are not unique to South African SMMES, as evidenced by international initiatives to direct specific assistance to small business enterprises. In South African, however, there is an opportunity to address the environmental impact of SMMES as part of increased state support for this sector. There is a need both to address environmental problems caused by existing SMMES and to assist new business enterprises to establish themselves on a sustainable basis. This has implications for broader government SMME policy.

### **Implications for SMME policy**

SMMES will have more difficulty complying with requirements for higher standards of environmental control than larger, corporate enterprises. SMMEs experience a disproportionate cost associated with environmental requirements. Cumulatively, SMMES may also have disproportionately critical environmental impacts. A policy of promoting dispersed, small-scale business activity will also spread environmental problems, which increase the difficulty of providing environmental controls, including the containment of pollution and management of waste. In more developed countries there has been a trend towards the establishment of centralised waste treatment facilities with advantages of economies of scale and the use of best available technology for processing specific waste materials. Economic incentives and technological capabilities are needed to drive such developments, which are probably most suited to built-up urban areas where such centres will be close to sources of waste. They may not be the best solution, however, for businesses in more dispersed locations where distances for transport of wastes are much greater.

The absence of conditions to stimulate interest in environmental control for SMMES has also discouraged investment in innovative technological development of cleaner processes for small-scale production, as well as pollution control and waste management. Such developments have been encouraged in other countries by enforcement of regulation and by economic incentives. In developed countries the environmental services and product

sector has become very valuable commercially, while developing countries which lack this technological expertise have become dependent on foreign assistance. South Africa could benefit highly from supporting national capacity-building in environmental expertise, particularly in relation to SMME management.

A lack of serious attention to environmental performance may threaten the sustainability of SMMES. The Indian example (discussed previously) illustrates the extent to which the public may revolt against unacceptable environmental degradation caused by lack of control of industrial activity, even though they may be economically desirable. SMME operators should be aware of their environmental responsibilities, as their future social responsibility may depend on it.

Environmental trade constraints are also an important factor. SMMES established in South Africa with a view to international trade will need to be able to adopt environmentally acceptable production processes and be prepared to be audited to verify product and performance acceptability. Thus, poor environmental standards may be a constraint to the ambitions of potential exporters in the SMME sector.

Broadly speaking, government policy should provide leadership by stating an environmental policy position in such a way that commerce, industry and the public will respond proactively to environmental challenges. Specific government measures or programmes may be necessary to address critical environmental problems, control specific business activities which are most threatening to health, safety and environmental integrity, or subsidise activities which may have long-term environmental and socio-economic benefits but which are not supported by existing market conditions. These principles apply to SMME development as a component of broad industrial environmental policy.

The Department of Trade and Industry has, since 1994, given more attention to environmental issues and sought ways to link environmental performance to state assistance. The directorate dealing with SMME development has also indicated its interest in integrating environmental concerns with broader SMME development programmes.

It is unlikely, however, that environmental support, services or regulations for SMMES will be sustained separately from other services. It is, therefore, desirable to integrate environmental issues into the broader support services already in place. The principles and mechanisms proposed in the Small Business White Paper could be supplemented by the inclusion of environmental policy objectives in each of the proposed areas of support. Appendix 1 (see P. 189) summarises these principles as well as some possible new objectives. Environmental competence can then improve simultaneously with other skills.

A number of specific recommendations are outlined below. These strategies seek to draw on existing infrastructure or programmes in order to avoid the creation of new institutions.

### **Environmental services in local business service centres**

The Department of Trade and Industry, in cooperation with the Department of Environmental Affairs and Tourism, should sponsor environmental services at the local business service centres currently being established. This could initially be done on a pilot basis where environmental specialists could be placed in the service centres to advise and

train entrepreneurs in environmental management. This training and advice could be offered on a group and one-to-one basis, and could be tailored to the specific needs of the businesses concerned. There could also be seminars for entrepreneurs working in the same sector which would focus on the particular environmental challenges facing that sector. Larger companies in the same sector could be brought in to discuss their environmental perspectives and clarify what they expect from suppliers. Service centres may also need to supply grants or loans to support the acquisition of equipment to be used for health, safety or environmental protection. The local business service centres could also be used to coordinate various other initiatives as described below.

### **Hazardous waste and materials recycling services**

We have seen that one of the main problems facing small companies in the automotive service sector is the lack of appropriate facilities for the collection of hazardous wastes and for recycling of materials. This does not, off course, refer to paper and glass recycling, for which there is already an adequate infrastructure, but rather to various other industrial materials, and chemicals in particular.

International experience shows that, in many cases, materials recycling can be self-sustaining or even profitable if sufficient economies of scale can be achieved. Economies of scale require coordination between SMMES. Similarly, SMMES are more likely to comply with hazardous waste regulations if there is a coordinated service which would take waste off entrepreneurs' hands without entailing major cost.

This suggests that municipalities and local business service centres could usefully set up waste and recycling services at a local level—specifically to service SMMES. The exact nature of these services and the types of wastes/materials that should be targeted would depend on the sectoral breakdown of activities in various areas. In metropolitan areas where a wide range of activities are likely to be present, a wider range of waste collection and recycling services would need to be established.

### **Sectoral workshops in key sectors**

The automotive services case study presented here suggests that interventions need to be made on a sectoral basis in order to address the specific needs of particular kinds of enterprises. One way to upgrade the environmental consciousness and capacity of SMMES would be to establish closer links between large and small enterprises working in the same sector. The larger enterprises would be able to assist smaller enterprises (especially if these enterprises are their suppliers) in addressing environmental as well as health and safety problems. In some cases larger enterprises could also provide waste collection and other infrastructure.

This could be taken a step further if government were to charge larger enterprises with the responsibility to ensure that their suppliers were meeting with key environmental or health and safety requirements. This may be useful with regard to critical issues such as controlling particular hazardous wastes currently entering the waste stream or combating common health and safety problems.

This would fit in well with international trends which encourage duty-of-care responsibility for larger enterprises using a cradle-to-grave approach. This would mean large companies taking some responsibility for the environmental performance of suppliers. Larger companies could, therefore, be encouraged to give greater assistance to their suppliers, customers, subsidiaries, franchisees, and other smaller businesses who are involved with their products.

### **Information and training services**

Government and non-governmental organisations also have an important role to play in providing information and training to SMMEs. On the information side a number of services could be envisaged. This would include the possibility of seminars at the local level which seek to inform small entrepreneurs of their legal responsibilities and point out the environmental effects of their activities. Such seminars could also inform people about services that are available, and ways in which they could be assisted in meeting their responsibilities. There would have to be a mix of general information relevant to all SMME operators, and sectoral information relevant to particular types of enterprises. These seminars could potentially be arranged by local government in cooperation with national departments such as the departments of Trade and Industry and Environmental Affairs and Tourism. Publications could also be sent out to entrepreneurs with useful information and lists of resource institutions. This requires, of course, that the relevant institutions would have the capacity to reach small businesses.

Similarly, it may be useful to provide training opportunities for SMME operators. Short, focused training courses, which would ideally be certified, could be offered to operators. These courses would empower operators to manage their environmental, health and safety impacts more effectively and to take proactive steps to solve environmental problems.

### **Enforcing regulation**

The measures outlined above all aim to offer some sort of support to entrepreneurs and operators. This is undoubtedly necessary in order to raise levels of environmental awareness and capacity. However, in addition to these services, SMMEs also need to be put under some pressure to meet their environmental responsibilities and legal requirements. There are a number of ways in which this could be done. Firstly, inspection services could be strengthened. However, given resource constraints, this is likely to be limited. It may, therefore, be preferable to emphasise strategies which link government support to businesses' willingness to meet their environmental and health and safety responsibilities. This could include making preferential loans and access to support services, conditional on the demonstration of sound health, safety and environmental performance. Again, this will require coordinated action by government departments and local service providers.

## Concluding remarks

In recognition of growing international concern about the environmental impacts of industrial activity, this study was conceived to explore the significance of environmental problems linked to SMME activity. The case study of selected automotive service activities in the Cape metropolitan area cannot reflect fairly the situation in all sectors. However, it highlighted weaknesses in skills, awareness, ethics, institutional support and government policies. This impacts on the sustainability of SMME activity and, therefore, environmental issues should be integrated with SMME policy development at an early stage, and not neglected until environmental problems become critical barriers to SMME growth.

This chapter has identified some ideas for short to medium-term strategies to address the environmental problems of small business, as well as longer-term policy. More detailed studies are required to identify and assess specific policy mechanisms for sound environmental management of SMMES in a range of industrial sectors and geographical locations.

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**APPENDIX 1** Summary of environmental policy objectives for the SMME sector

<b>SMME policy principle</b>	<b>Environmental policy objective</b>
Appropriate regulation	Regulations should ensure protection of worker interests, occupational and community health and safety and practicable prevention of environmental degradation
Facilitate access to information and advice about: market opportunities, appropriate technology and finance	Appropriate environmentally related information and services should be made available to new and existing businesses as part of a business development programme
Need to be aware of environment: entrepreneurs should be advised timely of a government position on environmental policy before investing in technology and production of products which may be considered environmentally unacceptable and for which there may be no sustained market. SMMES should be able to respond to changing market requirements.	Newly empowered South African considerations which may change patterns of production and consumption, resulting in changing market demands
Facilitate access to finance	Utilise international funding which is available for environmentally related projects
Provide suitable physical infrastructure	Include appropriate waste management facilities e.g. waste transfer stations, specialised waste treatment centres
Provide incentives for development in specific areas for minimum environmental impact of any proposed development or activity	
Planning and zoning should consider environmental impacts of any proposed development or activity	

<b>SMME policy principle</b>	<b>Environmental policy objective</b>
Facilitate human resource development: foster entrepreneurial attitudes in school curricula, training courses, business mentorship, internships and apprenticeships big business training facilities available to SMMEs mobile training programmes, applied research about SMME needs	Education and training should include subjects related to environmental protection, and should seek to raise the general level of awareness about environmental issues and provide skills to address these problems
Improve labour relations by improving skills to enhance productivity and competitiveness of enterprise	More efficient processing also has environmental benefits with cost savings
Facilitate access to appropriate technology industry or sector specific programmes required to channel sophisticated technology to modern manufacturing and services, but 'appropriate' technology to labour-intensive, low skill spheres role for manufacturing technology centres	Research and development should seek to provide cost-effective and appropriate small-scale waste treatment technologies and to identify viable cleaner technology options for smaller scale industrial processes
Facilitate joint ventures, cooperative relationships between large and small businesses i.e. linkage programmes, local economic development partnerships, local business service centres	Consistent principles of environmental performance should be abided by
Environmental responsibility should be accepted business practice. Suitable service providers should be part of the network of local business service centres	
Facilitate capacity-building improved institutional support from business associations and trade unions; greater assistance from local government departments	Business associations should encourage environmental responsibility among members companies
Provide financial incentives, including: differential taxation, tax credit for reinvestment; training; research; technology transfer; more generous depreciation; allowances incentives for loans to SMMEs incentives for offering lower-cost services to SMMEs	Similar incentives could be used to reward investment in cleaner technologies or money spent on projects for reducing environmental problems

## chapter 7

# UNIONS AND ENVIRONMENT

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## Life, health and the pursuit of employment

Pelelo Magane, Shirley Miller, Michael Goldblatt and Lael Bethlehem

### Introduction

Trade union members truly work at the coalface—they are the first to experience the health, safety and environmental effects of industrial activities.<sup>1</sup> South African workers are exposed to a range of threats to their health and safety, and they are often members of the communities which experience industry's broader environmental impacts most strongly. For these reasons, trade unions have a strong interest in health and safety issues, as well as in industry's environmental impact. South African trade unions have a strong history of involvement in health and safety issues and, in recent years, there have been moves to incorporate a broader environmental agenda into union policies. Although not all environmental issues fall within the usual ambit of union activities, there is a strong potential for linkages between the activities of unions and those of environmental groupings, and there are some experiences of successful alliances between labour and environmental groupings in South Africa. This chapter explores the way in which South African trade unions have organised around health and safety issues, and their more recent initiatives on broader environmental questions. We argue that the trade union movement in South Africa has played a key role in the development of safer approaches to work and, while union perspectives on *safety* issues are best known, there have also been important interventions on *health* issues and, more recently, on *environmental* questions. However, we note that there is still an enormous amount of work to be done to change industrial practice in ways that will protect workers, their communities and the environment. There is also a great deal to be done to improve the ability of the union movement to intervene effectively in these matters. We therefore make a number of recommendations about ways in which the health, safety and environmental capacity of unions can be enhanced.

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<sup>1</sup> Pelelo Magane and Shirley Miller conducted this research while on sabbatical from the Chemical Workers' Industrial Union. The views expressed in this paper are not necessarily those of the union. The authors thank the members of the trade union reference group for their assistance with this project, and also Rod Crompton, Jabu Ngcobo and Paul Benjamin for providing information and comments.

## The health, safety and environment continuum

It is widely accepted that the workplace environment can be seen as part of a continuum with the broader natural environment (Davies 1993). Many analysts have pointed out that workers are exposed to toxic industrial agents earlier and more directly than members of the general population (Baker and Landrigan 1993), and that workers' health is, therefore, directly at stake. Industrial pollutants are also not limited to the workplace, as hazards are released from the workplace into the environment which pollute the air, water or biological systems. The Thor Chemicals case presents a stark South African example of the links between the effects of workplace management on health, safety and the environment (see Butler in this volume). There are also numerous other examples of the link between workplace health hazards and broader hazards both in South Africa and internationally. In fact, some of the milestones of the environmental movement—events that brought world attention to the environmental dangers of industrialisation—were of this nature. These events, including the disasters at Bhopal, Basel and Chernobyl, showed that industrial hazards—dangerous on the shop-floor—were also dangerous to surrounding communities and the natural environment. In 1984, a methyl-isocyanate spill from a Union Carbide plant killed several thousand people at Bhopal, India; in 1986, an explosion and fire at a nuclear power plant in Chernobyl in the Soviet Union killed 20 people and forced the evacuation of 135 000 others; and in Basel, Switzerland, in 1986, a fire at a Sandoz warehouse caused 30 tonnes of agricultural chemicals and 200 kilograms of mercury to pour into the Rhine River, making the water unfit for human consumption over hundreds of miles in four countries (Dembo *et al.* 1988). While these are the incidents that grab the headlines, there are also more subtle links between the environmental and the occupational hazards of industry. This is evidenced by a long experience of occupational health problems being the first pointers to the hazardous and environmentally toxic nature of industrial chemicals (Thorpe 1993).

### A zero-sum game? Jobs versus health, safety and environment

Health, safety and environmental issues are, therefore, of critical interest to trade unions and their members. But unions also face difficulties in taking up these concerns. One of the key difficulties is the relationship between jobs, on the one hand, and health, safety and environment, on the other. Indeed, one of the central concerns of this book is the relationship between the general development process and the protection of the environment. Nowhere is this debate clearer than in the debates about the relationship between job security and employment creation, on the one hand, and health and environmental protection, on the other. Too often employers have tried to present employment and environmental objectives as mutually exclusive. This has been evident internationally as well as in South Africa. Three recent events illustrate the potential difficulties posed to the union movement. The first was the St Lucia case in which Richards Bay Minerals planned to mine titanium in a sensitive wetland area. After a long and very public debate, government decided, in 1995, that mining would not be allowed to go ahead. This affected potential mining jobs as well as existing jobs in the nearby Richards Bay

processing plant. The second example was the threatened suspension, in 1995, of the commissioning of Iscor's R4,7 billion Saldanha Steel project. This was due to delays caused by environmental pressure because of its siting near a sensitive lagoon area, and because of potential requirements that the plant be sited a few kilometres inland from the lagoon. Iscor used the threat of foreign exchange losses and decreased job creation as arguments for downplaying the environmental problems raised by local activists (Koch 1995). The third example, in 1996, was the potential closure of the Grootvlei gold mine near Johannesburg, due to its inability to pump out its water at an acceptable quality. At one point in the controversy, the mine management argued that it would be forced to close the mine if the Department of Water Affairs and Forestry enforced its pumping ban, and said that this would lead to the loss of 2 000 jobs. In this case, the mine used the threat of job loss to argue for a reduction in environmental standards.

Without exploring these cases in detail, they are sufficient to demonstrate the fact that major industrial development decisions are having to include environmental criteria as never before in South Africa. They also illustrate that companies are well aware of the potential contradictions facing the labour movement, and are trying to polarise the environmental debate into a "jobs versus environment" choice. While internationally the debate around sustainable economic development has largely progressed beyond this crude polarisation, it appears as if South Africa is going to have to re-examine many of these questions for itself. Much like industrialists once used the threat of job losses to oppose improvements in health and safety conditions, some have shifted the same argument to environmental protection.

But let us look at the jobs versus environment debate more closely. In some cases, there *is*, in fact, an absolute conflict—we either choose to approve a new investment or to conserve an important area. Indeed, in the St Lucia case, government eventually argued that no mining could go ahead, given the sensitivity of the wetland. Other examples might occur as certain kinds of chemicals (such as certain organo-chlorines and asbestos) are phased out. But, at present, such cases are rare. Most often, creative solutions can be found that balance environmental and economic imperatives. In the Grootvlei case, for example, the National Union of Mineworkers (NUM) argued that jobs must be preserved but that environmental solutions *also* need to be found. When presented with the old jobs versus environment dilemma, the union argued that there was room for both. And, indeed, the resolution of that case so far indicates that acceptable solutions can be found without closing the mine. As the United Steelworkers of America argue, "In the long run, the real choice is not jobs or environment. It's both or neither." (United Steel Workers of America 1990).

Vic Thorpe, general secretary of the International Chemical Energy and Mining Federation, has argued that "jobs can be lost in any time of change—and the changes ahead are enormous—whether we fight for or against them. But protecting our own futures—whether in our present jobs or in a set of new, cleaner industries—will depend on our collective action." (Thorpe in Lukey 1995).

In many situations, then, it is possible to be guided by a perspective which seeks to address environmental concerns in ways that also protect workers' jobs. A similar debate exists over conflicts between jobs and workers' health. Employers sometimes argue that higher

health and safety standards would be a threat to employment. But South African unions have traditionally taken a more integrated approach. For example, despite the hundreds of deaths in the mining industry annually, union members have not opposed mining *per se*, but have argued that it be *managed* in a way that dangers are minimised. And, yet, mining exacts a bitter price from the workforce. Recent findings of research work on the health status of gold miners in the Libode district shows that a large proportion of career miners develop devastating lung diseases that tend to become acute only when the miners have retired or have been retrenched (Trapido 1996). Similar evidence has been found for ex-migrant mineworkers living in the Thamaga district of Botswana (Steen 1997). These diseases not only lead to a shorter life expectancy but also to extreme pain and discomfort, especially in the latter stages. In this sense, workers have paid a bitter price for their wages on the mines. The key question, however, is whether it is possible to create mining jobs that are safer and healthier, not whether those jobs should be created at all. Indeed, in the South African context, where a third of economically active people are unemployed, jobs are often a matter of life and death. Despite all the publicity about the deaths of workers at Thor Chemicals in the early 1990s, there was never a shortage of job recruits. For many unemployed workers, the value of life cannot easily be separated from the value of a livelihood.

But, as Vic Thorpe suggests, it may be that some industries, or parts of some industries, will not survive the very long-term restructuring that will come with higher levels of environmental awareness. This raises a fundamental question of the sustainability of the path of industrial development chosen by South Africa or any society. As Jacobs argues:

Economic activity is precisely about using resources (taken from the environment) to produce goods and services, with resulting wastes (deposited back into the environment). If environmental considerations are not more fully incorporated into economic policy, there is no hope of tackling the environmental crisis. (Jacobs in Crompton and Erwin 1991).

Part of the challenge for unions, therefore, is to be involved in industrial and macroeconomic management, as well as improved management of individual workplaces. This includes an investment strategy which seeks to promote investments in environmentally sustainable industries and production methods.

### **Looking back and looking forward**

We have argued so far that health and safety issues are linked to environmental concerns. Nevertheless, health and safety issues are distinct from environmental issues and have, historically, been much closer to trade union agendas. Over the years, some South African unions have been closely involved in health and safety issues, and have contributed to important changes in health and safety policy. In general, safety issues have been highest on the agenda because they are so immediate. Safety forces itself onto the agenda, especially as a result of periodic and highly visible accidents in South Africa's mines and factories. Health issues are less visible, and the health effects of various industrial activities, including mining, often take years to develop. Intervention on health issues also require higher levels

of expertise and technical understanding. It is also true that health issues are difficult to track because there is very little record-keeping in industry. The long latency period of occupational disease compounds this problem. When workers present health problems in a particular workplace, they are often unaware of what they have been exposed to in the past, and this makes it difficult for unions to take up the issues.

Looking back over the last 20 years, it seems evident that trade union approaches to health, safety and environment have been initiated for the most part by concrete demands on the ground, rather than a uniform, structured approach. This is illustrated by the emergence of stronger interventions in those unions which operate in highly hazardous sectors, such as mining and chemicals. We will argue that this has sometimes led to an approach which is more reactive than proactive.

Health, safety and environment campaigns have often been catalysed by a flow of information and solidarity from international trade unions and other organisations. For example, one of the pioneers in health, safety and environment, the National Union of Textile Workers (a forerunner of the Southern African Clothing and Textile Workers' Union), was alerted to the hazards of cotton dust by its American counterpart, the Amalgamated Clothing and Textile Union of America, in the early 1980s. The National Union of Textile Workers was, at the time, engaged in a bitter fight for recognition with the Frame Group of textile manufacturers. At the time, black workers contracting byssinosis (or "brown lung"—the disease affecting the lungs of cotton textile workers) were not compensated by the Department of Manpower. Once alerted to the problem of "brown lung", the union engaged in a huge campaign to test workers, and to organise them in the process. Unable to use company premises or hospital facilities for the testing process, the union set up a makeshift testing facility in a church in Clermont, a township close to the factory in KwaZulu-Natal. In the early hours of the morning, textile workers coming off night shift would stream into the church hall where lung functions and other medical tests were carried out by a full-time union doctor. The findings of this survey were repeated at other factories around the country, and eventually formed the basis for changes to compensation legislation as well as technological improvements in cotton factories throughout the country. An important aspect of this campaign is that the National Union of Textile Workers used the campaign to organise new union members. This shows that health and safety issues can also be an important organising tool.

Indeed, it has often been trade unions that have helped to challenge poor conditions, rather than statutory committees that have ostensibly been set up to do so. It was action taken by the Chemical Workers' Industrial Union (CWIU) in 1986, for example, that exposed the poisoning of workers at a Port Elizabeth plant owned by a British multinational. Workers' exposure to acrylamide, a known neurotoxin, was brought to the notice of a union organiser by an alert practitioner at the local hospital. A particular worker was suffering the chronic effects of acrylamide poisoning, but this had been continuously misdiagnosed. Once the disease was correctly diagnosed, the CWIU was able to negotiate access for an occupational medicine specialist who established the source of the poisoning. This led to changes in the production process to eliminate exposure. Workers who had been affected were appropriately treated and compensated.

Similarly, the conditions at the subsidiary of another British multinational, Thor Chemicals, (see Butler in this volume), galvanised the CWIU to organise and assist those workers. Again international assistance was evident. Information about the process carried out at Thor was brought to the attention of the CWIU and Earthlife Africa, a local environmental group, by Greenpeace and international union organisers. The union then actively recruited these workers and a long political and legal campaign was initiated. In the course of the campaign, the CWIU received considerable support from its international trade union secretariat, who provided technical assistance in the various court cases. The Thor case also illustrates the importance of local alliances. At a local level trade unions, local communities and environmental groups forged important links in the protection of their living and working environment. Thus began the cooperation between Earthlife Africa and the CWIU. The two organisations have continued to cooperate while maintaining their separate identities and specific focus areas.

Although these examples illustrate effective responses by unions to assaults on their members' health and safety, they also illustrate an important weakness: in most cases, these gains have not been translated into long-term programmes of action. For example, the experience of exposure to toxic substances at a local level could have been translated into national campaigns for the right to know about the hazards that workers are exposed to. It has been this inability to move from reactive to proactive campaigns that has been the major weakness. We believe that this could largely be attributed to the fact that health, safety and environmental issues have been marginalised by being placed outside the collective bargaining process. We return to this point later.

One area, however, where unions have successfully taken the issues to the national level has been in the arena of challenging legislation. Trade unions saw health and safety legislation as an integral part of apartheid. This position was recently captured in comments made by union lawyer Paul Benjamin:

What ... the system really meant was when workers got sick or injured they got sent back to the homelands with little or no money, and somebody was hired in their place. Nothing was done to prevent similar accidents happening again.

The system meant that accidents were cheap for bosses and expensive for workers.

Trade union struggles led to a number of changes to legislation. For example, unions fought various provisions of the 1983 Machinery and Occupational Safety Act, which signified a significant shift in government policy from one of proscription to one of self-regulation.<sup>2</sup> A number of these provisions were changed with the passing of the Occupational Health and Safety Act of 1993. This Act extended the formal jurisdiction of the law to include industrial disease. It also made provision for workplace safety representatives to be elected

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<sup>2</sup> The Machinery and Occupational Safety Act's approach to the management of hazards at the workplace effectively excluded trade unions. A system of shop-floor structures, safety representative and safety committees was established. These were largely ineffective in that safety representatives were appointed by management, were not accountable to workers and, thus, had little credibility. The committees often operated at low levels of the enterprise and were only advisory. Unions continued to act outside the framework of these structures, with the Metal and Allied Workers' Union going as far as court to win the right to negotiate a health and safety agreement in one of its companies.

rather than appointed by management. However, the Act still basically relies on a self-regulatory approach and is still being criticised by unions.

More recently, the Leon Commission of Inquiry into mining safety was appointed and legislation was amended in line with the Commission's recommendations. The NUM played a key role in this process. The new Mines Health and Safety Act, which came into effect in January 1997, fundamentally changes the way in which mineworkers' health and safety is addressed. Similarly, unions fought for the introduction of regulations governing workers' exposure to hazardous chemicals. Before 1995, regulations for hazardous chemicals were restricted to lead and asbestos, despite evidence of the effects of a range of other chemicals. The hazardous chemical regulations of 1995 follow international trends and regulate previously uncontrolled hazardous chemicals in the workplace. There is still concern among unions, however, that the facilities to monitor compliance with the regulations are inadequate. In addition, a number of legislative challenges still remain. We return to these later in this chapter.

### **Environment: an emerging issue**

We have looked at a number of examples of trade union work in health and safety, and we have noted that environmental issues have been taken up increasingly in the 1990s. This can be seen in union involvement in certain local environmental issues, such as the struggle over the closure of the Chloorkop waste site, the Grootvlei mine incident, the controversies over industrial projects at St Lucia and Saldanha, as well as the Thor case. In addition, union federations (and especially COSATU) have been involved in criticising and formulating environmental policy at the national level. In 1993, the African National Congress-led (ANC) Alliance arranged an environmental policy mission with the assistance of the Canadian International Development Research Centre. The mission included representatives of the ANC, the Congress of South African Trade Unions (COSATU), the South African Communist Party and the South African National Civics' Organisation, as well as local and international environmental experts. The Alliance mission produced a report on environmental policy in South Africa which was far-reaching and has influenced the content of subsequent policy documents, such as the environment Green Paper. Thereafter, the trade union movement became more centrally involved in environmental policy through the Consultative National Environmental Policy Process (CONNEPP), which became the key mechanism for consultation and formulation of environmental policy. A COSATU representative served on the steering committee of CONNEPP.

During this period, COSATU held a landmark health, safety and environment policy conference, and followed this up with a national environmental policy workshop in 1996. The 1995 conference was in itself a recognition of the importance of health, safety and environmental issues and of the need to strengthen COSATU's capacity in this area. The conference began with a recognition that, while the union movement has had an impact on health and safety and environment, there is still much to be done. During the conference, COSATU general secretary Sam Shilowa argued that:

In our 10 years as COSATU we have given enough attention to politics and to economic policy but not enough to social issues such as health, safety and the

environment.... Our lives as workers were cheap under apartheid. Bosses had it easy and they could get away with murder. Even government policies were designed to undermine our health and safety and our environment. Now we say we must struggle on this issue. We must make the price too high for the bosses and government to continue in this way.

Similarly, COSATU president John Gomomo argued that despite 10 years of struggle as a federation, COSATU still needed to give more attention to health, safety and environmental issues:

We remain with a long agenda of issues that we will still have to tackle.... Key in this agenda is the need to struggle for a fundamental change in policies related to occupational health, safety and the environment.

The conference made a number of resolutions, including that COSATU should:

- support the "polluter-pays" principle;
- support a cradle-to-grave approach to waste management, and should campaign to ensure that companies take this approach;
- take up campaigns in heavily polluted industrial areas and encourage companies to take collective responsibility for their areas; and
- expose and resist the dumping of toxic waste.

The conference also resolved that:

- communities should be consulted before waste disposal sites are established in their areas;
- South Africa's environmental advisory councils should be restructured, and COSATU should be represented on all structures dealing with environmental policy; and
- South Africa should adopt the relevant International Labour Organisation and other international conventions, including the Bamako Convention on the trade and transportation of toxic waste.

In addition, the conference resolved that COSATU should develop more detailed policy in the following areas:

- coastal and marine management;
- forestry;
- pollution control;
- zoning;
- recycling;
- control of mine dumps; and
- toxic waste.

These resolutions signal that, while COSATU does not yet have very detailed environmental policy, the issue is firmly on the agenda, and the federation intends to participate actively in this area.

After the conference, a COSATU representative was appointed to the committee charged with drafting the Green Paper on environment. COSATU, therefore, became a key player in the environmental policy debate. Much of the content of the Green Paper reflects the centrality of the labour movement and its concerns in protecting the environment and workers' rights as part of that environment. This is evident in the way in which the concept

of environment was defined in the Green Paper, and the developmental approach that was taken. Unions and allied community organisations approached environment as a developmental issue that centres on the quality of life. In this sense, "brown" environmental issues are emphasised, rather than a narrow emphasis on conservation.

But what is the proper role for trade unions in environmental work? We have noted that there is a strong connection between the effects of industrial activities on workers and on the broader environment. Unions, therefore, have a strong interest (or potential interest) in issues of industry and the environment. This includes waste management, accident prevention, production and transportation of hazardous materials and industrial emissions to air, water and land. To the extent that environmental questions also have a bearing on industrial and economic development, they are also of critical importance to unions. It is in this context that issues such as climate change and international environmental questions become important. Indeed, the relationship between trade and the environment, and the inclusion of environmental issues in international trade agreements, are also critical. However, it is also true that trade unions will need to focus their environmental campaigns and concerns where they are most able to effect change and are unlikely to become deeply involved in environmental issues that fall outside workplace and economic concerns.

### **Structures and policies: are unions adequately equipped?**

We have seen that unions have taken up health, safety and environment issues in recent years. However, their ability to take up these issues in an ongoing and proactive way requires established union capacity. In order to gauge unions' present capacity, we conducted a brief survey of unions' health, safety and environment structures. This survey concentrated on the COSATU unions.

The interviews we conducted explored the health, safety and environment structures and policies of the unions. One of the questions we asked was whether unions have distinct health, safety and environment structures, or whether these issues are handled in general structures. We found that in most cases health, safety and environment issues were handled by union officials who also had a range of other responsibilities. However, two affiliates—the NUM and the CWIU—had separate, full-time health, safety and environment officials in their head offices. In both cases, the health and safety officials were located in the collective bargaining divisions of the union. Since the interviews were conducted, two more unions—the South African Municipal Workers' Union and the National Union of Metalworkers of South Africa—decided to appoint dedicated officials.

Along with dedicated organisers, some unions, such as the CWIU, have distinct health, safety and environment committees at branch, region and national level. Apart from these unions, coordination of health and safety issues is generally located within unions' education departments. Only two out of 16 COSATU affiliates had no national official responsible for health, safety and environment issues.

The unions which do have full-time health, safety and environment officials have been able to work with members at the level of the enterprise, as well as in the policy arena. The NUM and CWIU, in particular, have been able to coordinate campaigns, assist

workers in negotiating health and safety agreements, manage the aftermath of industrial accidents and advise workers about their participation in health and safety committees. Both unions have also played a strong role in contesting legislation and policy.

It is clear, then, that some unions have dedicated structures and officials for health, safety and environment, while others integrate the issues with other areas. The success of a health, safety and environment programme in a particular union, however, cannot be judged simply by whether or not the union has established dedicated structures and officials. Indeed, there is a debate among unions about which is the better strategy. On the one hand, separating health, safety and environment from collective bargaining—the heart of trade unionism—can serve to marginalise the issue; on the other hand, there is a danger that where the health, safety and environment issue is added to a list of other responsibilities, the issue may receive insufficient attention. Much depends on whether the unionists who are dealing with health, safety and environment as part of a broader portfolio are sufficiently conscious of, and knowledgeable about, health, safety and environmental issues. We conclude, therefore, that while unions do not necessarily require separate officials and structures, they do need people who are knowledgeable and enthusiastic about health, safety and environment, and who can devote time to the issue. The separateness or otherwise of structures is not the key debate—the key is whether the issue receives sufficient attention and resources. Each union needs to design the organisational structures that suit them.

At the level of the national union federations there is also some debate about structures and the role of the federations in facilitating affiliate organisation of health, safety and environment. Until recently within COSATU, health, safety and environment issues were coordinated by the education department at the federation's head office. Recently, however, the responsibility for the function was shifted to the negotiations department. There has been a recognition, however, that the health, safety and environment issue has to form part of all areas of the federation's work, including organisation, campaigns and education. There are also calls from COSATU affiliates for the federation to facilitate additional aspects of health, safety and environment. The 1995 conference grappled with some of these debates. In the course of our survey, four suggestions emerged for further work at the level of the federation. Firstly, there is a need for centralised training courses for shop stewards and union officials on various aspects of health, safety and environment. In particular, organisers need skills which will assist them to negotiate these issues at the work place level. We return to this point later. Secondly, there is a need for better liaison between union affiliates in a particular area. For example, in a highly industrialised area like Gauteng, it is useful for unions from different industries to get together to tackle environmental problems in the area as a whole. Companies often argue that they are not responsible for a particular problem (say, air emissions) in an area, but rather that it is the company down the street. A COSATU structure coordinating the efforts of workers from different companies could play a useful role in these circumstances. Thirdly, there is a need for cooperation between unions across a value chain. It has been pointed out that, for example, in the chemical chain, CWIU members produce certain chemicals which are then transported by Transport and General Workers' Union members, used by South African Agricultural, Plantation and Allied Workers' Union members, and then disposed of by

South African Municipal Workers' Union members! There should, therefore, be cooperation between these workers—for example, in handling the effects of a hazardous chemical. Fourthly, some unions have argued for a common COSATU position on the joint employee-employer committees that are supposed to be set up at every work place according to the Occupational Health and Safety Act. In reality it seems that few work places have them. Should the unions encourage these structures, even though they are not union-based? Or should they rather argue for a new set of structures which would operate between the employer and the union structures, along the lines of the Mines Health and Safety Act? It may be useful for COSATU and other union federations to develop a common position on this question.

It is also worth noting that COSATU and its affiliates have historically been concentrated in manufacturing, services and mining. But, recently, COSATU launched a new trade union for the agricultural sector. The union, the South African Agricultural, Plantation and Allied Workers' Union, organises workers on commercial farms and in various types of agricultural companies, including forestry and tea plantations. There is a myriad of health and safety (to say nothing of environmental) issues in the agricultural sector. Although these have not been well explored thus far, they are critical to this sector and represent an important organising issue for this new trade union.

### **Challenges for the future: priority issues in health, safety and environment**

Developing a stronger capacity to organise around health, safety and environment issues is no easy task. It is one thing to talk of balancing health, safety and environment concerns with jobs and economic development, but what does this mean in day-to-day terms? Similarly, what do unions need to deal effectively with issues that arise at workplaces and in the policy environment in which they operate? Do South African unions have the necessary strategic, organisational and technical resources?

In the following section we make recommendations that will address these questions. In addition, we highlight areas for union intervention in public policy. We argue that there are a number of critical areas in which the trade union movement should intervene in the coming years.

Priorities for internal union organisation: entrenching a collective bargaining approach. We have argued that health, safety and environment are best understood as relating to workers' rights, and should, therefore, be seen as part of the process of negotiation rather than as a technical issue to be handled by "experts". When health and safety issues are simply handed over to experts, they become separated from the process of organisation and bargaining, that is, the basis of trade union power.<sup>3</sup> At the same time, effective interventions in health and safety rely on a degree of understanding of work place conditions and potential remedies. Without such an understanding, it is difficult for workers and their representatives to interrogate management views and proposals.

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<sup>3</sup> This, of course, does not imply that unions do not require the assistance of specialists but, rather, that technical services should be part of a broader strategy that is based on a process of negotiation.

Similar points can be made for environmental issues which, at the work place, are often linked to health and safety. It is important to note, however, that work place environmental issues are not always directly linked to health and safety, and that workers and their representatives need to have a grip on the broader environmental issues, as well as health and safety, to enable them to integrate these issues with the collective bargaining process.

We argue that if unions are to successfully impact on workplace health, safety and environment, they need to incorporate these issues into collective bargaining from a position of strength and knowledge. In order to achieve this, shop stewards and organisers need both consciousness and knowledge of these issues, as well as the backup of resource people both inside and outside union structures.

This raises two requirements: firstly, training for shop stewards and organisers (and workers in general) and secondly, union structures that facilitate collective bargaining. We have seen that some unions choose to appoint dedicated health, safety and environment coordinators, while others incorporate this function under organisational and/or educational responsibilities. While we do not wish to prescribe either route, we do argue that every union needs to ensure that its officials can take the lead on health, safety and environment issues, and that they can offer real services to workers struggling with these issues at the workplace level. At the same time, if education programmes are to succeed in this arena, the educators must have an adequate level of consciousness and knowledge of the issues.

How is this to be achieved? Training for union officials and shop stewards can usefully be achieved through centralised training programmes and institutions such as Ditsela, the new trade union training organisation. These courses need not be purely technical in nature, but could rather empower workers to take up a range of health, safety and environment issues which relate to the process of union organisation. At the same time, workers need to be better trained in all industries. This can hopefully take place more effectively once government's new human resource development strategy has been put into place. It is important that in the new human resource development system health, safety and environment are identified as core training issues for all workers, and that training is offered by providers that have a degree of legitimacy with the union movement.

### **Union approaches to policy: the debate about self-regulation**

In recent policy debates, industry representatives have often argued for a self-regulatory approach to health, safety and the environment. However, this approach may not be helpful in the South African context. Indeed, the Leon Commission of Inquiry into mining health and safety had been critical of the operation of self-regulatory policies in the mining industry. It concluded that these policies had failed and had contributed significantly to the poor health and safety record of the mining industry. The new Mines Health and Safety Act provides for active state regulation and enforcement, while providing for the social partners to negotiate further mechanisms, especially at the local level.

Unfortunately, self-regulation in South Africa has largely been interpreted as deregulation rather than the development of appropriate mechanisms at the work place to promote occupational health and safety. Local mechanisms are critical since the law and

state institutions cannot anticipate every local situation. Indeed, there is no substitute for determined, knowledgeable and innovative local management. However, local initiatives must take place within the strict framework of nationally set standards.

The union movement has traditionally called for stricter regulation and enforcement, while, at the same time, promoting the negotiation of health and safety at the plant level. Although health and safety must be considered a collective bargaining issue, the state needs to lay down minimum standards which are in line with international best practice.

There are several reasons why we argue that the concept of self-regulation, while popular in Europe, may have limited application in the South African context. The notion of self-regulation assumes a high degree of competence and consensus between the social partners. In South Africa both of these ingredients are in short supply at the workplace level. As Dawson *et al* (1988:239) suggest:

It is thought that inspectors in the United States need to use the law to a greater extent than for example in Sweden where there is a good deal more consensus in the political culture, and all those concerned are prepared to seek agreement without recourse to external constraint. South Africa is probably closer to the USA than Sweden in this comparison.

Dawson *et al*, who conducted a study of self-regulation of health and safety in the UK, make other points that are relevant to South Africa. Firstly, they argue that line managers often do not have the training, sophistication or interest to manage a self-regulatory approach to health and safety:

It emerged that the most important ingredient in effective self regulation of safety at work is the role and commitment of line managers. Without such commitment, formal provisions such as the writing of a safety policy or the establishment of a safety committee need have not positive effect on the level of risk" (1988:246).

We believe that in South Africa a minority of line managers have the expertise to manage this area effectively. Secondly, Dawson *et al* argue that effective self-regulation requires strong access to information:

Other commentators have indicated that the effective operation of a deregulated market for health and safety at work is dependent on freedom of information so that all parties have access to expert knowledge. The argument here is that if employers are to be free to make their judgement on the costs and benefits of any particular action then employees must surely have the same right to make their own judgement about their participation. In order to make such a judgement, employees need access to the same information about hazards at work as their employers (1988:256).

In the South African context union officials and shop stewards often have too little access to information and expertise, and sometimes lack the skills to interpret technical information. If these factors make effective self-regulation difficult in the UK, how much more so for South Africa?

In addition, although access to power and information are unequal in many sectors, they are particularly so in sectors like agriculture, forestry, construction and domestic work, where unions are weak and workers extremely marginalised. In these sectors, in particular,

self-regulation has very limited potential.

Although the unions have been less active in the debate over self-regulation in environmental management than in health and safety, many of the same points hold. Indeed, it is clear that where workers' health and safety is in danger, the environment is in danger too. Regulatory and managerial mechanisms are needed at work places in the interests of both workers and the broader environment.

In light of these points, we argue that unions need to take a double-pronged approach in the debate over legislation, policy and practice. Unions need to fight for minimum standards to be set and enforced by the state. At the same time it is clear that whatever standards are set at the national level, there needs to be a process of implementation and continuous improvement at the local level. This involves negotiation between unions and management. In order to ensure that such negotiation is effective, unions need to have a consistent approach at the workplace level. Importantly, shop stewards and organisers need to be trained and need to have access to resources and expertise.

### **Amending legislation**

At the 1995 Cosatu health, safety and environment congress, Paul Benjamin argued that "the health and safety system is really one of the last surviving bastions of apartheid". He was drawing attention to the fact that the legislation and institutions that governed health and safety under apartheid are still in place. As with environmental legislation (see Currie *et al* in this volume), health and safety law is fragmented. Several statutes and government departments regulate the protection of workers' health and safety and the compensation for accidents and disease. The preventative laws are the Mines Health and Safety Act of 1996 and the Occupational Health and Safety Act of 1993, while the compensatory legislation is similarly split between mining<sup>4</sup> and other economic activity by means of the Occupational Disease in Mines and Works Act of 1973 and the Compensation for Occupational Injuries and Diseases Act of 1993.

Recent changes in the areas of mines health and safety have led to a situation where the laws governing mining are fundamentally different in their philosophy to those governing the rest of industry. One of the most important differences is that the Mines Health and Safety Act gives trade unions a strong role, whereas the Occupational Health and Safety Act relies on non-union health and safety committees. While taking some steps towards acknowledging the role of trade unions by enforcing consultation with representative unions about the election of safety representatives, the Act largely downplays the role of unions. In contrast to this, the new Mines Health and Safety Act gives prominence to trade unions by giving a representative trade union the right to negotiate collective bargaining agreements around health and safety.

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<sup>4</sup> The Occupational Disease in Mines and Works Act only covers lung diseases in the mining industry. Other occupational diseases in mining are covered under the Compensation for Industrial Injuries and Diseases Act.

Not only is the legislation fragmented, but so is the responsibility for its implementation. The key government departments are the departments of Mineral Affairs and Energy and Labour. However, the Department of Health plays a crucial role in facilitating the recognition and treatment of ill health and injury through health services. Although the Department of Health has no direct responsibility for the enforcement of health and safety laws, the department is the key repository of expertise, and also runs the National Centre for Occupational Health. According to Benjamin (1995), the lack of coordination between departments has resulted in "absolute chaos and ultimately and more importantly, no-one takes final responsibility for health and safety". As long ago as 1975, the Erasmus Commission of Inquiry made a recommendation for a unified approach to occupational health. However, more than 20 years later there is still no overall body with responsibility for the development and implementation of health and safety law.

There is a myriad of other problems in relation to compensation, some of which have to do with poor laws, and others with the poor implementation of the law. The low level of claims for occupational disease (as opposed to accidents) reflects the degree to which occupational illnesses go undetected; this is largely because there are few mechanisms to assist workers in identifying and claiming for occupational disease. In addition, mineworkers and other workers have differential access to services from the state. Mineworkers have greater access to compensation-linked medical examinations and advice than other workers. Another difficulty is that hospital-based and private doctors are too often uninformed of occupational disease or of health and safety compensation. They often lack the expertise to diagnose diseases that are specific to certain kinds of jobs, and often fail to make links to workers' employment or refer workers to compensation channels. Trapido's (1996) work shows that rural migrant workers were completely ignorant about their rights to compensation for mining-related diseases, and suggested that if workers were informed of compensation and assisted to apply, many more black workers would have to be compensated.

There are also problems related to the low levels of reporting and compensation. Given that by accepting compensation workers effectively give up their right to a civil claim, compensation levels should be adequate to make up for their loss of any potential civil claim.

The areas of health and safety legislation and compensation, therefore, present critical challenges to the union movement and should be seen as a priority area for intervention.

### **Statistics and information**

One of the factors that makes it difficult for unions to engage effectively in health and safety policy is the lack of reliable information. Information is generally only available in relation to those incidents which must be reported under law, or which, for some other reason, are investigated by the Department of Labour. Given the limited nature of company reporting requirements (and the link between reporting and compensation), these statistics probably reflect only a small proportion of the incidents affecting workers' health and safety. Indeed, it seems clear that health issues, in particular, are endemically under-reported since industrial diseases often take a long time to develop, and since it is sometimes difficult to prove that the worker has contracted the disease as a direct result of his/her work.

According to official statistics, in 1995 a total of 942 workers died in South African industry and a further 533 died in the mining sector. Of those who died in industry, 492 worked in the transport sector, 114 in building, 89 worked for local authorities, 59 in iron and steel companies and 14 in the chemical sector. The Department of Labour investigated 10 556 occupational health and safety incidents in industry alone. The vast majority of these incidents and deaths occurred as a result of accidents rather than disease. It is likely that this figure would multiply if deaths resulting from long-term exposure to occupational hazards were known.

It should be noted that these figures do not include shipping, and also do not include sectors such as agriculture and domestic work, where very little information is available. Similarly, as Goldblatt argues in this volume, very little information exists in the public arena on industry's emissions to the environment. One of the consequences of this is that workers and communities have no way of knowing what they are being exposed to in their living and working environments.

It is difficult to contest policy and propose changes without reliable information on what the problems are. Unions, therefore, need to push for better data collection and for better monitoring of workers' health, especially in those industries where there is evidence of long-term disease.

### **Union involvement in national and international restructuring**

At the beginning of this paper we noted that environmental, health and safety issues arise partly in the course of the restructuring of industry. This restructuring is taking place at a rapid rate in South Africa today, due to the various pressures of trade liberalisation, globalisation, political shifts and technological change. The process of restructuring is also catalysed by changes in environmental management and practice. Such changes have implications for the number of jobs available, as well as their quality. If trade unions are to influence the path of restructuring (and especially the way that environmental questions are handled), their presence will have to be felt in sectoral, national and international initiatives.

Union involvement in restructuring is all the more urgent given the enormous changes taking place in industry, and in manufacturing in particular. Unions are increasingly having to deal with trends such as subcontracting, new forms of work organisation, new technologies and the promotion of small business. Some of these trends have consequences for health and safety and the environment.

Many South African trade unions are already involved in a programme of "cluster studies"—investigations into the competitive prospects of South African industries, under the auspices of the Department of Trade and Industry. Unions can help to ensure that environmental restructuring questions are put on the agenda. In addition, unions can involve themselves in international environmental initiatives and, perhaps most importantly, international conventions and agreements, including those on climate change, trade in chemicals and in waste and biodiversity. These conventions may well have serious implications for industrial development and employment.

### **Improved state services**

One of the most glaring areas of inadequacy in health, safety and environmental administration is the poor level of services available to workers. This is especially true for workers and ex-workers who are suffering from an occupational disease which has taken many years to develop. Trade unions have a limited ability to assist with compensation, facilitate medical examinations and process claims. Unions, therefore, need to pressure the state to offer "one-stop-shop" compensation services to workers. In many areas workers have existing legal rights—for example, free medical examinations at specified centres—but do not know about them or how to access the facilities. Strong union pressure could encourage the state to offer these services around the country.

Improvements to government's occupational health and safety inspection services are also needed. Not only are more inspectors required, but they need to be trained to work effectively with workers and unions at the factory level. Too often inspectors visit a factory without discussing problems with the workers themselves. Trade unions could usefully pressure the Department of Labour in this regard.

### **Conclusion**

We have argued that the South African trade union movement has had considerable influence over health and safety policy at a national and workplace level. We have also pointed out certain weaknesses in the trade union programme and made some suggestions in this regard. We have also seen that, in recent years, the unions have started becoming involved in environmental policy and have argued that there is a strong link between the health and safety of workers and the integrity of the environment. At a policy level much needs to be done, both in relation to health and safety and environment. In order to influence such policies, and in order to participate meaningfully at the workplace level, unions require an ongoing process of capacity-building and coordination.

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## chapter 8

# LESSONS FROM THOR CHEMICALS

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## The links between health, safety and environmental protection

Mark Butler

### Introduction

The tragic events at Thor Chemicals have become a landmark in the history of environmental struggles in South Africa.<sup>1</sup> They brought to the fore the inextricable connections between the health and safety of workers and the broader natural environment. They were also a demonstration of the dramatic failure of the administrative and legal systems which were meant to protect the health of workers and the integrity of environmental resources.

While not on the scale of the Bhopal disaster, Thor Chemicals was a warning sign that the systems which South African society, industry and the state had established were insufficient to meet the challenges of handling toxic and biologically hazardous materials. The disentangling of the events at the company will help us to understand the weak points within these environmental and occupational health management systems and to improve them. If industry is to use hazardous chemicals it must be in a position to manage them safely. It must also not be able to do this by passing the risks to either its workers or to society at large. If the state allows the use of hazardous chemicals by industry it must be in a position to ensure that industry is able to do so responsibly. The crisis at Thor Chemicals showed us that these conditions were not being met and that we should learn its lessons to ensure that it does not happen again.

### A brief history of environmental, health and safety issues in the company

In 1959 Thor Chemicals was founded and registered as a company. It began as a small "backyard" operation in Margate, England, established and owned by Des Cowley. Thor

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<sup>1</sup>This chapter is presented in memory of the Thor workers who have died. It was written as a contribution to the campaign to expose what went wrong and to prevent similar occurrences in the future. Given the nature of some of the issues addressed in this chapter, certain sources of information must necessarily remain confidential.

Chemicals is now a British-based multinational which is involved in the manufacture and processing of chemicals. It has a number of operating, wholly owned subsidiaries in various countries, including the USA, Germany and South Africa. Most of these subsidiaries are not manufacturers but rather brokers of Thor's products. The South African division of Thor Chemicals was established in 1963.

From 1978 monitoring by British health inspectors showed environmental health problems and poisonings at the Margate plant. The findings of the UK health and safety executive indicated that the health of British workers was being negatively affected. A 1981 inspection at the UK plant found airborne levels of mercury 20 times higher than the acceptable limit, and in 1983 another inspection at the UK plant found the same high levels persisting. By 1987, the health and safety executive, which was still finding unacceptable levels at the Margate plant, issued an ultimatum to Thor—to either clean up or face court action (UK health and safety executive 1994). That year Thor discontinued its mercury operations in the UK but its South African mercury processing operations continued.

### **Thor Chemicals in South Africa**

Senior Thor staff who had been involved in the Margate plant were responsible for transferring its mercury processing operations to South Africa by designing and establishing a plant at Cato Ridge, KwaZulu-Natal, where the factory remains to this day. Thor built its mercury reprocessing facility in the late 1970s, following the signing of a contract in 1976 to supply mercury catalysts to the South African firm, African Explosives and Chemical Industries (AECI). Consequently, the establishment of this plant was accompanied by massive imports of mercury wastes into South Africa by Thor. Thor chairman Des Cowley said:

Because of the quantity, we also agreed to develop a method for recycling the mercury. It was very obvious, because of the nature of the mercury compounds, that one could not continue to manufacture them unless you were prepared to recycle them.

And so Thor's trade in mercury wastes began. Besides recycling spent catalysts from AECI, Thor began importing mercury wastes from all over the world, burning them in its incinerator and extracting the mercury to resell. "Economically it is an extremely viable trade," said a chemical engineering expert who did not want to be named. "The purchase price is very low, and the sale price of the finished products, very high" (Kockott 1994, unpublished notes).

The African residential areas near the Thor plant are economically very depressed and so, on the whole, people were glad to have a factory that provided jobs. Comparatively speaking, Thor is one of the best employers in the area. As a senior black worker at Thor said (cited in Kockott 1994: 5):

Full-time employees get medical aid for themselves and their families, very good pay, free transport to and from work, and cheap food on shift. I do not know of another factory that can offer this.

It would appear, however, that the health and safety problems that had earlier been identified in Margate, England, were replicated at the Cato Ridge operation.

## The production processes at Thor Chemicals

There were essentially two distinct, mercury-related aspects to Thor's operations at Cato Ridge. On the one hand, Thor ran a mercurials plant to manufacture organo-mercury-based compounds (biocides and battery fillers). It was in this section that workers suffered the poisonings that would become the focus of much attention and a court case. On the other hand, Thor set up a series of processes to recover mercury from used mercury-related wastes which they would take from international industries for a fee.

There were three other plants at Thor, in addition to the mercury-related processes discussed above:

- one produced metallic soaps which are used as paint-drying chemicals;
- another section dealt with textile additives and non-mercurial biocides; and
- the third was a catalyst plant. This plant was in some senses separate from the recycling plant but it is where Thor produced mercury catalysts. Therefore, this plant has a link with the mercury problems generally associated with Thor. This plant takes mercuric chloride ( $HgCl_2$ , which Thor produces by combining metal mercury (Hg) (which it gets partially from its recycling process and partially by purchase) with chlorine ( $Cl_2$ ), and impregnates it into carbon up to an 11% concentration. This product is then sold to customers as a catalyst for producing polyvinyl chloride. The link between this product and Thor's recycling plant occurs because, after use by client companies, the activated carbon still contains mercury up to a concentration of 4%. The customers then pay Thor a processing fee to take back this spent catalyst to recover the residual mercury left in the activated carbon. After reclaiming the metal mercury, it is purified and used in the production of mercuric chloride, which takes us back to the early stage in the cycle described above.

## Thor Chemicals' mercury recycling: A potentially good idea?

If we leave aside for the moment the inherent dangers of working with substances like mercury, we can see why some have argued that Thor's process was environmentally a good idea. Thor produced a marketable product, took back the depleted catalyst and contaminated sludges (wastes) after the product had been used, and extracted the mercury from those in order to make more of the original product. Ideally, the process would have been a "closed loop" production system with the least possible environmental contamination. When the Wildlife Society of Southern Africa asked environmental consultant Ray Lombard to investigate and report on Thor Chemicals and mercury pollution in 1990, he praised the factory's processes. He concluded that "Thor Chemicals should be encouraged to continue with the recovery process" (Lombard 1990). Lombard argued that:

In the case of Thor Chemicals the importation of spent catalyst ... is an important source of raw material.... This is not a disposal operation! It is a recovery process.... The elimination of toxic waste from the waste stream through resource recovery is an elegant application of the European Greens' non-waste technology option of environment protection.

But it appears that the recycling never worked as it was theoretically meant to.

### Thor Chemicals' recycling of mercury in practice

The basic idea underlying the production process was that wastes which had mercury in them could be burned at high temperatures in order to, on the one hand, destroy or make harmless the non-mercury part of the wastes, while on the other hand, vaporise the mercury so that it could be collected through condensation. Thor's first attempt at recovering mercury was by means of a small fluidised bed furnace. This did yield some metal mercury from spent catalyst, but only on a small scale. During this time the incoming spent catalyst grossly exceeded the capacity of the fluidised furnace to process it.

Therefore, Thor decided to build a larger cellular furnace which could process up to a maximum of two tonnes per day. Like the small fluidised bed furnace, the larger one required the physical loading of mercury wastes into the furnace. Despite suction, introducing flammable liquids into this furnace would result in huge flames from the loading port. Also, the burnt solid wastes or residues from this process were still too dangerous for disposal on a normal landfill site, and they were periodically put into drums and stored in warehouses at Thor.

However, even this larger furnace was not large enough and the stockpile of mercury wastes which Thor had taken back but could not process, was increasing. It was decided to build a rotary furnace which could handle up to 12 tonnes of material per day. Thor completed construction of this new rotary kiln incinerator in 1992. This furnace was more advanced in design, and there are some critics of Thor who believe that if this furnace had been operated properly and if certain, relatively expensive, modifications had been made, it would have been a worthwhile operation. The aim was to incinerate mercury catalyst and wastes, thereby producing solid waste, which would be disposed of, and reducing  $Hg^+$  and  $Hg^{++}$  to  $Hg^0$ , that is, metal mercury. The metal mercury would then be purified by distillation in the distillation plant, after which it could be used to produce the mercuric chloride product which Thor sold.

In its trial phase, the rotary kiln incinerator could only deal with spent catalyst and not the other sludges and wastes that Thor had accumulated from clients across the world. The composition of these sludges and wastes varies from the contaminated protective clothing of workers in processing plants to dangerously contaminated concrete from such plants, and came from such sources as reactor washings and plant clean-ups. An attempt to mix these sludges with carbon was unsuccessful because the exothermic reaction—that is, its reactions with the heat generated by the furnace—made it impossible to load into the feed silo. Therefore, sludge that emanated from AECI, Borden Chemicals and Plastics and American Cyanamide remained largely unprocessed.

In addition, some of the design features that would have helped make the process safer were allegedly never adhered to. For example, the continuous mercury monitor which was supposed to control atmospheric emissions and which was linked to a string of safety devices was never functional. Also, an emergency carbon filter and a normal processing carbon filter were supposed to be charged with sulphur-impregnated carbon to trap any mercury breakthrough. According to reliable sources these were never properly functional until January 1994 after the Department of Air Pollution Control discovered in November 1993 that the normal processing filter contained incinerated carbon and that the emergency filter was empty (Kockott 1994: 18).

Although it was meant to be better than Thor's previous processes for retrieving mercury, the rotary furnace still produced solid residues from its incineration process that were too high in mercury content to be disposed of by usual means. Thor decided to deal with this problem by disposing of these residue wastes into a plastic-lined dam on its own property.

We have seen above that Thor experienced ongoing difficulties trying to process the wastes that it was being paid to take from industries all over the world, because it never really had sufficient technical capacity to do so. This created a serious backlog and, as a result, Thor had a storage capacity crisis with the large volumes of existing and incoming wastes. Therefore, it also decided to dump drums containing solid residues from previous attempts at recovery, into the dam to free up warehouse space.

In February 1994, an African National Congress-sponsored delegation toured Thor. They found three warehouses on Thor's property containing at least 10 000 barrels of mercury wastes.

Of particular concern was the number of rusting, leaking, overturned and spilling drums, and rusting drums and wastes strewn on the floor.... Mr van der Vyver [Thor's managing director] admitted that Thor had not been processing the stock-piled waste ... and that the incineration process had been unable to retrieve usable mercury.... The only real profit to be gained from the waste was that Thor was paid over one thousand dollars per ton to receive it (Kockott 1994: 7).

### **Thor's operations come to public attention**

In a letter written in response to queries from the office of international activities of the USA Environmental Protection Agency in February 1986, Thor Chemicals Inc. (1986), from its branch in Norwalk, USA, said it believed that its plant at Cato Ridge "is the world's largest, continuously-operating recovery plant for processing Mercury metal and Mercury chemicals from spent catalyst. This is the first time that our intentions to reclaim and recycle Mercury and Mercury chemicals from spent catalysts have been questioned. ... You asked about environmental impact, and we can state that it is nil."

In South Africa the alert was sounded after water quality problems downstream of Thor's plant were noticed.<sup>2</sup> On 14 July 1988, Umgeni Water Board's regular monitoring of water quality picked up levels of mercury in the Umgeni River—more than 15 kilometres downstream from Thor—that were 1 000 times higher than the World Health Organisation's drinking water standard. They traced the problem back to a spring adjacent to Thor's property.

The Department of Water Affairs and Forestry is the regulatory authority with the responsibility to enforce the law relating to the pollution of water sources. However, it did not act against Thor. In August 1989, an official of Umgeni Water, frustrated by the lack of action to deal with the problem, leaked the information to the local press. By September

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<sup>2</sup> The following is summarised from Kockott 1994.

the department announced an investigation into Thor's water pollution. In November 1989, a reporter from a USA newspaper sampled water at the head of the Mcgweni River, which is fed by a spring a little distance away from the plant. The reporter found some of the highest levels of mercury pollution ever recorded (Lambrecht 1989, cited in Kockott 1994: 17). In February 1990, Greenpeace researchers took soil and water samples around the plant, proving that Thor was responsible for the pollution. Sediment samples were 8 000 times higher than the USA standard for classifying a substance as hazardous waste.

### Poisoned workers

During March 1990, Earthlife Africa, which had been monitoring and exposing issues related to Thor since the pollution story first broke in South Africa, first heard reports concerning the impact of Thor's operations on the workers at the plant. Workers were reported to be "going mad". According to Koch (1991):

in April 1990 protests were launched by the Earthlife branch in Pietermaritzburg in cooperation with the CWIU and Greenpeace International. The protests were directed not only against Thor, but also against the US multinational, American Cyanamide. The corporation exports about 10 tons of waste to the South African plant each year. Black peasants, white farmers, students, unionised workers, green activists and a traditional Zulu chief banded together to protest at the importation of toxic waste to South Africa and held a large demonstration outside the gates of Thor. Rod Crompton, General Secretary of the CWIU, commented that the protest signalled the potential for a powerful 'rainbow alliance' between green groups and the country's black labour movement.

These protests were supported by other organisations. On the same day, protests in New Jersey, USA, against shipments of mercury waste from American Cyanamide to Thor, were violently broken up by riot police (Kockott 1994: 3). The Industrial Health Unit, a non-governmental organisation in South Africa, was also very important in providing independent medical services to the workers at Thor, and in analysing and publicising the impact of Thor's operations on its workers.

During April 1990, under pressure from the South African government, Thor's mercury-related operations were suspended because of mercury pollution. In September that year, South Africa announced a ban on waste imports, but quietly granted Thor an exemption to the ban on condition that it only import toxic waste generated directly from the use of catalyst they produced (Kotze 1990). On 15 April 1991, Thor's client company, American Cyanamide, announced that it would no longer ship wastes to Thor due to the "fuss and furore" surrounding these activities. During the same year, however, officials from another major Thor client, Borden Chemicals and Plastics, visited Thor and declared it to be "well-kept and well-maintained" (*The Times-Picayune*, 1994).

At the time when critical issues concerning the environment and workers' health and safety first emerged, workers at Thor were not represented by a trade union. The CWIU won a recognition agreement at Thor Chemicals in August 1991. In the same year tests on workers by the Industrial Health Unit showed that 87% of workers had mercury levels that were above the safe limit of 50 parts per billion and that the average level was 200 parts per

billion. The Industrial Health Unit called for a full government inquiry but received no response from the authorities (Colvin 1992).

### **Thor before the International Water Tribunal**

Early in 1992, Earthlife Africa was instrumental in taking the Thor matter before the International Water Tribunal. The tribunal's hearings were hampered by the refusal of the South African government to release important information, and by Thor's refusal to attend the hearings. The tribunal (1992) found that there was insufficient evidence to directly link Thor's operations to pollution of water sources, but stated:

The defendant's [Thor's] response to the complaint was misleading and evasive.

... An independent environment assessment should be carried out and the results made public.... Since there is limited access to information in South Africa, and since, in this case, the industry is working with a hazardous substance, it is of vital importance that populations who think they are at risk should have the rights to information and access to courts.

The process was useful in creating greater international and media exposure around the issue. Earthlife Africa stated that it was satisfied with the verdict of the jury and called on Thor and the government to accept and implement the recommendations made. The organisation reiterated its call for a judicial commission of inquiry into the whole matter (Earthlife Africa 1992).

### **Thor workers hospitalised**

On 25 February 1992, a Thor worker, Peter Cele, was admitted to hospital. There was no diagnosis and no specific treatment, and he lapsed into a coma. On 3 March, another Thor worker, Engelbert Ngcobo, was admitted to hospital. He, too, lapsed into a coma after no diagnosis, and no specific treatment was given. On March 18, Albert Dlamini was admitted to hospital by Thor after reportedly going berserk at the plant.

### **Report by the National Centre for Occupational Health**

During April 1992, Professor Tony Davies, of the National Centre for Occupational Health, conducted an inquiry into the health of workers and safety conditions at the plant. Subsequent screening of Thor workers revealed that 28% of the workforce were in danger of permanent damage from mercury poisoning (Kockott 1994: 24). Professor Davies's report and the subsequent formal enquiry by the Department of Manpower at Thor were important for the subsequent formulation of criminal charges against Thor. Davies completed his report in April 1992. It indicated that there was "indisputable evidence of a risk to the health of workers at Thor Chemicals" (*Natal Witness* 1992a).

Growing public pressure and media exposure of the issues at Thor resulted in a formal Department of Manpower enquiry into mercury contamination at the Thor plant. The enquiry, conducted between 13-15 July 1992, revealed gross negligence leading to the poisoning of at least 29 workers (Davies 1992).

### Criminal prosecution initiated

Key outcomes of the Department of Manpower's enquiry were a number of recommendations about the future operation of the Thor factory, and the handing over of the report to the Attorney-General of Natal, Tim McNally, to consider criminal prosecution against Thor. In October 1992 it was reported that the Department of Manpower had handed over its report on Thor to the Attorney-General's office. According to a report in the *Natal Witness* (1992b), a spokesman for the Attorney-General's office confirmed that they had received the report, which he described as lengthy and complex. He added that "it would take some time to 'go through' before action, if any, is taken".

On 9 December 1992, the Director-General of the Department of National Health gave permission to Thor to import CINNCARB, a sulphide of mercury (Department of National Health and Population Development 1992). The previous exemption from the "ban" on importing hazardous wastes that had been granted to Thor was on condition that the "company does not accept spent chemicals for recycling other than those originating from your company" (Kotze 1990). CINNCARB is a hazardous waste generated by the American company Calgon, based in Indonesia, and does not originate from Thor.

Shortly after this permission was granted, a former Thor employee, Peter Cele (aged 22), died in July 1993 after 16 months in a coma in hospital. By August 1993 it was reported that the "results of tests done on a former Thor employee's body will be received by the Attorney-General's office this week, and a decision whether to prosecute the company will be taken shortly afterwards" (*Daily News* 1993). During September 1993, the *Natal Mercury* (1993) reported that the Attorney-General was considering adding a further count of culpable homicide to the original charges after the death of another former employee, T. E. Shange. Although Shange had died about three weeks previously, his position as a former Thor worker "only emerged after the *Natal Mercury* approached Attorney-General Tim McNally with a list of questions" (*Natal Mercury* 1993).

The Attorney-General had indeed sat on the "lengthy and complex" Department of Manpower inquiry report for a long time but, in August 1993, he eventually charged Thor Chemicals and three of its top management officials (Managing Director Steve van der Vyver, Manager Gavin Daniels, and Chief Supervisor William Smith) with culpable homicide—relating to the deaths of Thor workers from mercury poisoning, and 42 other charges under the Machinery and Occupational Safety Act. The Thor bosses appeared in court in November 1993 and the case was enrolled for trial in May 1994.

### Air pollution from Thor

During November 1993, Nelson Mandela visited former Thor employee Engelbert Ngcobo at King Edward Hospital. On that occasion, environmental activists drew the public's attention to further alleged environmental malpractices by Thor.

It was claimed by environmentalists that Thor had been burning toxic wastes at unsafe temperatures and without the required permit or license from the authorities, for a year. This incineration was taking place in Thor's new rotary kiln, which had been designed to burn hazardous wastes. This is a "scheduled process" in terms of South African

law and it, therefore, requires a government license to operate. Although Thor had applied for such a license, the chief air pollution control officer for South Africa confirmed that by late 1993 no such license had been granted.

An oral agreement for limited "test run" burning had been granted, but informed sources indicated that Thor Chemicals had been burning toxic wastes for the whole year—allegedly without even rudimentary monitoring and safety features. Chris Albertyn, of the Environmental Justice Networking Forum, said:

The air pollution from incineration at Thor poses a grave threat to the health of people and the environment in the area and we want to know why the authorities have failed to act.

In addition to the air pollution problems, Earthlife Africa said it had reason to believe that Thor was also disregarding government instructions and requirements by dumping the toxic ash from the incineration process into a dam on its premises instead of sending it to a licensed toxic waste site.

### **Further prosecutions?**

On 16 November 1993, Chris Albertyn submitted a complaint to the Attorney-General of Natal, drawing his attention to these alleged breaches of the law over and above those that were the subject of the existing criminal court case against Thor. Albertyn (1993) said:

I am taking the rather unusual step of bringing this complaint directly to you as a recent experience has indicated to me the inability of the relevant state authorities to adequately pursue this matter.

The Department of Water Affairs and Forestry (1993) said in response to these inquiries that "the reason why the ash ... is not disposed of at a Class 1 facility is because it is being stored on a temporary basis in the dam so that it can be further incinerated to remove most of the mercury. ... [Thor Chemicals] are at present considering applying for a [Class 1 disposal facility] permit and this Department is also considering requesting Thor to do so in order to legalise the current situation. The award of such a permit would then allow Thor to permanently dispose their waste products on site."

In April 1995, the Attorney-General (McNally 1993) finally wrote to Albertyn, saying that he had come to the conclusion that there were no prospects of a successful prosecution and that, accordingly, he would "decline to prosecute any person at this stage".

### **The legal battles over culpability**

Some of those who observed the conduct of the case against Thor were concerned that the state's prosecution was not sufficiently resourced and that, as a result, the case was not being contested on a level playing field. When offers of funding and support from international non-governmental organisations were rejected by the prosecution, some wondered whether the ineffective prosecution of the case was the result of a simple lack of resources or a deeper unwillingness to prosecute the case vigorously.

Thor's defence team managed to have 19 of the charges under the Machinery and Occupational Safety Act withdrawn, and also convinced the magistrate, on technical

grounds, that a number of demands relating to the safety of the workforce that had been made of Thor by the Department of Manpower were not enforceable. An observer of the court case notes that:

The strategy of the defence team appeared to be to create a distinction between the three workers who they admitted had been poisoned by mercury (Cele, Ngcobo and Dlamini) and the other retrenched workers whom it was implied, were misleading doctors by reporting signs of mercury intoxication in the hope of getting compensation. Clearly if poisoning were only established in relation to the three workers, the argument that the entire workplace was unsafe and hence the management negligent, would be undermined.

Thor had always argued, from the time of the Department of Manpower inquiry onward, that the illnesses of the three workers resulted not from long-term "chronic" exposure to mercury, but rather from one or two "acute" exposures for which the company was not responsible. Thor Managing Director Des Cowley had earlier developed and continued to use a "sabotage theory" to account for such acute exposures—that someone had deliberately exposed the three workers to massive doses of mercury by tampering with the air line that supplied their air hoods. By using the "sabotage theory", Thor separated the issue of the three workers who had died—and for whose deaths they were being charged with culpable homicide—from general exposure to mercury by the rest of the workforce.

Instead of immediately and proactively drawing on offers of international expertise to assess the veracity of such claims, it seemed that the prosecution was without its own agenda, and had gained its technical knowledge primarily from the defence experts. Therefore, the prosecution was effectively reduced to responding to the defence case rather than presenting a positive case itself. It appeared that the gathering of evidence by the Department of Manpower before and during the trial was deficient, and that there was inadequate pre-trial preparation in general.

The gap in technical expertise was ultimately recognised and the prosecutor argued for the participation of an international mercury expert and secured an undertaking from the state to cover the expenses involved in bringing such an individual to testify on the mercury poisoning issues raised in the trial. On 14 February, after three-and-a-half hours of intense debate, the prosecution's application for an adjournment to allow the international expert to testify was granted. This was a significant step and raised hopes of a successful prosecution.

On 17 February, however, the equivalent of a plea bargain deal was struck between the legal teams in terms of which Thor Chemicals admitted to limited grounds of negligence (especially not locking a door on the compressor room and thereby, by implication, allowing the "saboteurs" in to do their dirty work) and was fined R13 500, in exchange for having other charges against Thor executives, including those of culpable homicide, dropped. Most commentators agree that bringing in an expert of international standing on the issues relating to mercury toxicology would have greatly strengthened the prosecution's case and would in all likelihood have resulted in a rebuttal of Thor's defence claims of "acute" rather than "chronic" mercury exposure.

One of the world's few mercury toxicology experts, Dr Laszlo Magos, has reviewed the medical records of Thor workers Ncgobo, Cele and Dlamini, as well as the records of the mercury in the urine of the other workers at Thor, independently of the court case proceedings. He concluded (Magos 1995) that:

The workforce was at risk from mercury poisoning and it is more than probable that careful screening of workers for signs and symptoms would have resulted in an appalling number of cases of intoxication. ... The difference between the risk of staff and casual workers indicates that casual workers and staff workers did different jobs. It is most likely that casual workers were doing the so-called dirty jobs. ... It is clear from the medical reports of the three clients that their illness was not produced by a single acute exposure, but by a build up in their body burden. Their medical history during their employment demonstrates that their body burden and consequently the concentration of mercury in the central nervous system often were in the toxic range. ... The onset of acute intoxication is a few hours, and the main signs are acute pneumonitis with respiratory distress. This was not the case with the clients. This contradicts the sabotage theory. ... A more plausible explanation is that there was ... [a] high risk job [that] was given to casual workers.

He added that in his opinion:

... [T]he company operated the mercury plant for years without reducing exposure to acceptable non-toxic levels and the risk to casual workers in general exceeded the risk to staff workers. The use of preventative measures like 'sending home' and 'dismissal' is not a substitute for engineering control. ... I suggest that the company was aware of the technical error which finally resulted in the death of the one and the incapacitation of the other workers.

The effective plea bargain deal that was struck between the prosecution and defence prevented the court from hearing international experts and resulted in an outcome that was roundly condemned by unionists and environmental activists. Shirley Miller, of the CWIU, said "the magistrate had a moral obligation to wait for the expert evidence on the mercury poisoning before he passed sentence" (*Sunday Tribune* 1995).

Some considered that the plea bargain entered into by the prosecutor could be attributed to "litigation fatigue" and a fear of losing the case outright. Others considered the deal very sinister and a travesty of justice. Chris Albertyn, speaking for the Environmental Justice Networking Forum, said the "fundamental mystery was why, when the state had expert evidence on hand to prove their case of culpable homicide, they agreed to drop the charges" (*Weekly Mail* 1995).

### **Thor taken to court in the United Kingdom**

In addition to the criminal case, civil proceedings were brought, in England, against the English-based Thor companies and their chairperson, Des Cowley, on behalf of 20 South African workers and their families. Lawyers for the former Thor employees' families argued that, since Thor is British-owned and since there is an apparent continuity between the problems experienced at the old plant in Margate and the one set up at Cato Ridge by

Thor, the parent company owes a duty of care and is liable for damage and loss suffered by Thor employees at the South African plant.

Lawyers representing former Thor employees secured important supporting affidavits from the workers, and were confident about the ultimate outcome of their case against Thor (Leigh, Day and Company 1996). Nonetheless, lawyers anticipated that Thor would present them with as many procedural obstacles as they could in an attempt to delay, and even stop, the case's progress.

The British parent company argued that neither it nor Des Cowley was liable for events that transpired at the Cato Ridge Plant in South Africa. This argument was tested during a "mini-trial" on 27 September 1996 and judgement went against Thor. Mr Justice Maurice Kay, of the High Court in London, called for the case to be expedited and accused Thor of delaying the court case (*Daily News* 1996).

In April 1997 Thor Holdings agreed to a settlement of R9 million. Thor chairman Des Cowley argued that the company had "chosen to settle than incur punitive legal expenses" (Business Day 1997).

### **A commission of inquiry into Thor Chemicals**

After representations by the interested parties, the South African government decided to appoint a commission of inquiry into Thor Chemicals, especially to explore the problem of how to deal with the remaining mercury-containing wastes (Department of Environmental Affairs and Tourism 1994). The commission consisted of chairperson Professor D.M. Davis and three others. It heard submissions from a variety of parties, non-governmental organisations and trade unions.

The commission reported in May 1997 and found that "both the company and the previous government were to blame" for allowing Thor to import and stockpile more than 3000 tons of toxic waste. The commission report argued that "the evidence had revealed a total absence of coordination between the departments responsible as an inexplicable inefficiency and unexplained omission" (Business Day 1997a).

However the commission recommended that the existing stockpile of waste be processed either through incineration or burning. This proposal was rejected by the Environmental Justice Networking Forum which argued that further incineration posed a threat to public health.

By July 1997, no decision had yet been announced on further treatment of the stockpile.

### **The relationship between environmental and labour issues**

We saw earlier that the joint protest by Earthlife Africa, the CWIU, Greenpeace International and local community structures held in April 1990 at Thor's factory prompted Rod Crompton, then general secretary of the CWIU, to comment that the protest signalled the potential for a powerful "rainbow alliance" between green groups and the country's black labour movement. The convergence of trade union concerns for worker and work place health and safety and progressive concerns about the environmental impacts of dirty in-

dustrial practices, has the potential to strengthen both constituencies and to begin plotting a new course for the environmental cause in South Africa.

Although this potential is yet to be more generally realised, there can be little doubt that, in the case of Thor Chemicals, the overall campaign has drawn strength from the alliance between Earthlife Africa, the Environmental Justice Networking Forum and the CWIU. This alliance has also facilitated supportive networking with international organisations such as Greenpeace International.

There are important obstacles that will confront those who wish to take this process of building red-green alliances forward. In general, trade unions in South Africa harbour a legitimate degree of suspicion in working with greens. Historically, environmental debates and organisations in South Africa have been dominated by the white middle class. Very few environmental organisations and activists have substantial histories of involvement in broader struggles for economic and social liberation, and almost all environmental organisations in South Africa have much to learn from the trade union movement about organisational democracy, strategic thinking and the struggle for genuine transformation. In addition, environmental considerations are often considered to be in conflict with the job security of industrial workers represented by trade unions. (For a full discussion of this issue, see Magane *et al* in this volume.)

### **The policy implications of the Thor experience**

After consideration of the main features of the Thor Chemicals story, it is important to begin identifying key areas for attention and action if we are to prevent a repetition of the tragedy.

#### **Capacity-building and training in trade unions and for workers**

Trade unions, especially those located in sectors such as the chemicals industry, would service both their worker membership as well as the broader community better if particular attention was given to training and awareness-raising around relevant environmental and workplace safety issues. Current occupational safety training schemes favoured by management are not regarded as adequate by unionists.

#### **Technology transfer**

Thor's mercury operations had already shown negative impacts at the plant in the UK by the time the process was transferred to South Africa. It appears that these problems were imported to South Africa along with the importation of the mercury operations. There is currently no environmental and health-related scrutiny of technology and industrial plant when they are transferred to South Africa. The case of Thor Chemicals suggests that such transfers should be subject to standardised national procedures to assess likely impacts on the environment and worker health and safety. Such transfers should be subject to full disclosure of information concerning the impact on the environment and worker health and safety in the country of origin.

In addition, there is growing international consensus that any industrial or related process or substance that is transferred to another country should be subject to at least those environmental and workplace safety standards as would be applicable in the country of origin. Application of this principle should ameliorate the tendency for poorer countries to feel compelled to accept transfer of dirty technology or wastes which are no longer acceptable in developed countries.

### **Industrial location and environmental impact assessment**

Siting of proposed industrial and waste management processes must be subject to environmental impact assessments. For example, the siting of a mercury recycling plant in the catchment area of the Umgeni River—a key component of the water supply system of the area—was not itself subject to formal scrutiny.

Linked to the incorporation of environmental impact assessments in industrial location decisions, is the need to redress past problems associated with the siting of hazardous industry. Policy and practical steps must be undertaken to overcome the apartheid legacy of environmental racism that has left historically marginalised communities most at risk from environmental hazards. For example, the Thor case highlights the particular vulnerability of former “homeland” areas where industries were enticed to establish themselves by the government in terms of its industrial decentralisation policy.

Industrial planning and environmental and regulatory policy must be guided by the “precautionary principle”, that is, as long as the health and environmental impacts of an existing or proposed development, process or pollutant are unknown or uncertain, these should be considered dangerous. The onus and the cost of proving no danger to health and environment should rest with the party producing or using, or proposing to produce or use, such developments, processes and pollutants.

### **Transparency and participation**

Government-initiated independent commissions of inquiry can be useful tools for getting to the bottom of a problem. However, in order to achieve this aim efficiently, interested and affected parties must be involved from the beginning of the process. The proposed commission of inquiry into Thor Chemicals was in danger of derailing before it had even started because of government’s reluctance to consult widely while drafting the terms of reference. Unlike the history of commissions of inquiry under the apartheid regime, commissions should function openly and transparently and should aim to reveal, and not hide, the truth.

The public’s right to know must be strengthened and must be actionable, not only against public institutions but, where appropriate, against private concerns as well. Where public access to information is qualified by other considerations, interested and affected parties to the particular issue should be given privileged access to information. Workers should have the right to be informed and there should be a duty on the part of authorities, developers and industry to alert the public, workers and other affected parties to potential environmental impacts. Workers should have the right to refuse unsafe work, and should

be trained in all aspects relating to the particular process and chemicals they are to work with, so as to be able to identify when work is not safe.

### **Environmental enforcement**

Public authorities responsible for environmental and workplace safety, enforcement and prosecutions and the institutional and legislative framework within which they function, require fundamental reorientation. In important ways, this implies a transformation of the current institutional culture that pervades these institutions at present. Even having good environmental laws on the statute books is insufficient where there is a failure of institutional will and capacity to enforce them.

The Thor case, from beginning to present, is riddled with examples of bureaucratic incompetence, a pro-industry bias, failure to act timeously and effectively, reluctance to investigate allegations and dangerously low levels of knowledge and skills on the part of inspectors. Serious deficiencies in the enforcement of environmental safeguards have been highlighted in reviewing the Thor case. Umgeni Water failed to act sufficiently when mercury contamination of watercourses was first picked up. The leadership of the Department of Water Affairs and Forestry at the time also failed to act decisively until the matter had become a public scandal. Department of Manpower directives relating to operations at Thor were undermined by incompetence and a failure to ensure compliance. The Attorney-General of Natal withheld the decision as to whether to prosecute Thor for just short of a year, and has continued to show a reluctance to investigate further alleged violations by Thor Chemicals.

### **Self-regulation**

Increased capacity and greater political will to act effectively in the interests of workers and the environment should be accompanied by a serious review of the bias toward self-regulation by industry. It is particularly evident in a firm like Thor Chemicals that self-regulation too often means simply no effective and credible regulation—with disastrous consequences. The Thor Chemicals case has highlighted some of the failures of the current systems of environmental regulation of industry in South Africa. Government inspectors are currently too few in number and not skilled enough to fulfil the responsibilities they bear. Dealing with this lack of capacity will have a cost attached. However, if improved capacity and quality of monitoring are achieved, the savings should be significant—especially if the environmental and social costs that result from current weaknesses in the system are considered.

How, then, do we begin to develop a more effective system of regulation that will prevent similar occurrences in future? Briefly stated, the key debate is between, on the one hand, building sufficient and comprehensive governmental capacity and, on the other, self-regulation by industries themselves. (See Table 1)

It has been suggested by some that perhaps the most plausible way forward is to develop a system based on local conditions and needs which would maximise the advantages and minimise the disadvantages of both systems. Most importantly, such a system

**TABLE 1** Governmental regulation versus self-regulation

System	Advantages	Disadvantages
Government monitoring capacity	Independent	Expensive
	Publicly accountable	Requires wide range of expertise
	Standardised	Requires full complement of competent officials
Self-regulation by industry	Devolves responsibility and costs of monitoring to companies	Lacks credibility
	Encourages "peer pressure"	Those with most to hide cannot be relied on for credible information
		Relies on good faith of companies

would seek maximum credibility for minimum cost with the aim of effective environmental regulation of South African industry. A system which attempts to weld together government regulatory capacity and industry-based self-regulation mechanisms would have parallels with the well-established commercial practice of financial auditing. In place of financial records, industry would be tasked with keeping standardised and comprehensive records of a regulated set of environmental indicators.

It is important that worker representatives should participate fully in isolating these indicators and in the collation and scrutiny of data. Such data would be submitted to a public authority for scrutiny and independent auditing. Such data, it is suggested, should also be available to the public and should be incorporated into national public databases for the development of regular national environmental audits.

There should be a degree of flexibility in terms of how such a system of environmental regulation is implemented, which is sensitive to the capacity of industrial enterprises. If, in the name of self-regulation, the regulatory system places too heavy a burden, particularly on small, medium, and micro-sized enterprises, it will collapse because enterprises will simply not be able to afford to comply. Implementation of a regulatory system should ideally be part of a wider package that aims at creating an enabling institutional and regulatory environment for cleaning up industrial processes and practices. For example, participation in the regulatory system could also provide positive incentives—such as open access to information about environmentally sound technological alternatives and assistance with developing environmental record-keeping, costing and monitoring.

There remain important difficulties with this approach, however. A regulatory system must be both effective and credible. Failure to achieve either of these objectives undermines the whole enterprise and leads to inefficiencies and costs. Huge expense will result from failures to pick up problems timeously and from contestation of data and information around particular cases. In addition, monitoring and regulatory systems must be articulated with enforcement and judicial systems. The latter are clearly functions of the public sector, which implies that certain levels of capacity have to be developed and maintained in these sectors—even within a system based on self-regulation.

In addition, there are surely rational economies of scale in developing a core of skilled personnel within the public sector rather than duplicating such capacity within individual commercial enterprises. Read in conjunction with earlier comments regarding the savings that would result from a well-functioning monitoring and regulatory system, the development of governmental regulatory capacity should be considered an essential step towards a system which can deliver effective and credible environmental regulation of industry in South Africa.

### The international aspects

The global economy is characterised by a concentration of power, production and consumption in the advanced economies of the North. The most characteristic form of this economic activity finds expression in transnational capital—corporations which may have their headquarters in one northern country, but whose sphere of activity is global. The gap between this rich sector and the poor is widening as the logic of global “free trade” plays itself out.

The North is also rich in terms of vocal and relatively powerful environmental lobbies. Often this has resulted in fairly tight regulation of industries and practices that can cause polluting in these countries. As a result, production with dirty technologies and the disposal of dangerous wastes has become increasingly costly in northern countries. There is a charge that these activities are being displaced to poorer countries.

In these poorer countries, environmental and worker protection is weaker, and the profit to be made in transferring these problems from rich countries can earn desperately needed foreign exchange for the economies of developing countries. Greenpeace researchers have documented the systematic transfer of dirty technology and hazardous wastes from North to South. As Chris Albertyn (1992) noted in an address to the national environmental health conference in 1992:

The implementation of stringent waste disposal and pollution control regulations in Europe and the USA during the 1980s resulted in more than 1 000 schemes to ship toxins to countries with less protection for their people and the environment upon which they depend. In many cases the choice for economically strapped governments became poison or poverty.

The implication of this perspective is that, in the long run, preventing occurrences like the Thor saga is inextricably linked to the struggle to restructure the global economy in the interests of justice.

### **International conventions which regulate the waste trade**

It has been recognised that the trade and transfer of wastes—and especially dangerous wastes—around the world must be subject to some form of control. Recognising the pattern of transfer discussed above, many third world countries not only condemned industrialised nations but sought to ban all such dangerous waste imports. The Organisation of African Unity was at the forefront, calling such dumping “a crime against Africa and all its people” (Albertyn 1992). President Daniel Arap Moi of Kenya commented that:

Africa has rejected all forms of external domination. We do not want external domination to come in through the back door in the form of garbage imperialism.

The ground swell of third world anger led to a gathering in Switzerland in 1989. On the agenda of third world countries was an outright ban of all exports of toxic wastes from industrialised countries. However, given the strength of USA and European interests, the Basel Convention, as it became known, ended up becoming a treaty that legalised a controlled trade in toxic wastes. South Africa is a signatory to the Basel Convention. Not satisfied with the Basel Convention, 68 countries from Africa, the Caribbean and the Pacific, collectively known as the ACP countries, pressured officials from the European Community into banning all radioactive and hazardous exports from the EU to ACP countries.

At the same time many individual countries were quickly closing the sluice gates. Ninety countries outside Western Europe and the USA have now banned waste imports. In January 1991, the Organisation of African Unity adopted the Bamako Convention which prohibits the import into Africa of any hazardous wastes. Glazewski (1993) has noted that:

The Bamako Convention was instigated by the African bloc’s dissatisfaction with the Basel Convention’s provisions. It appeared that Basel encouraged rather than limited the transboundary movement of hazardous waste into Africa. ... Bamako is Africa’s response to Basel and clearly juxtaposed to it on a question of principle. ... The fundamental difference between the two conventions is that the emphasis of Basel is the regulation of trade in hazardous waste, while Bamako bans its importation into Africa ... The key objective of Bamako is to prevent the African continent becoming a repository of first world waste.

Based on the Thor experience, the logic of this key objective is compelling, and South Africa should accede to the Bamako Convention.

### **International solidarity**

The struggles around the Thor case in South Africa have highlighted the possibilities and challenges of international networking and joint campaigning. There are numerous ways in which this can be taken forward. International union federations can provide points of contact for linking workers at production and disposal sites in joint actions. International environmental organisations have been invaluable in providing information concerning production processes overseas, as well as information regarding transportation of hazardous wastes. And international alliances of legal experts and practitioners can be employed in developing legal strategies that span across continents.

## Conclusion

Thor Chemicals exposed the weaknesses in the regulation of industrial hazards, and in so doing tragically demonstrated that workers are at the front line of environmental hazards. South Africa's occupational health and environmental protection systems failed disastrously and must be reformed and improved to ensure that they do not fail again. Chief among these lessons is the need to upgrade and integrate government inspection services; the need to improve state prosecution of environmental cases and the dangers of unchecked self-regulation.

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# CONCLUSION

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## Outcomes and policy implications

Lael Bethlehem and Michael Goldblatt

Over the last three decades the environment has increasingly found its way onto the agenda. Individuals all over the world are more conscious of environmental issues, nations are more concerned about the sustainability of their economic activities and the international community has defined an agenda following the United Nations Conference on Environment and Development. Agenda 21, the programme which emerged from that conference, is an attempt to direct the energies of national and international agencies towards environmentally sustainable development.

South Africa has, in some respects, entered the environmental age rather late. The struggle against apartheid so consumed the national consciousness in the 1970s and 1980s that environmental issues seemed secondary. In the 1990s, however, there has been a growing understanding in South Africa that environment is a key aspect of economic and social development, and there has been a rising consciousness of environmental issues. Environmental organisations are growing, environmental education is improving and environmental policy is becoming more coherent. However, environmental concerns are not well-integrated with all facets of life, and environmental policy is underdeveloped in many critical ways. In this book we have looked at various aspects of industrial development and at ways in which environmental issues can be more successfully addressed in the industrial sphere. In this conclusion we reflect on the main lessons of the research presented in the various chapters and on the gaps that have been left by this work.

Chapter 4 of Agenda 21 focuses on changing unsustainable patterns of production and consumption. It states that:

[S]pecial attention should be paid to the demand for natural resources generated by unsustainable consumption and to the efficient use of those resources consistent with the goal of minimizing depletion and reducing pollution. Although consumption patterns are very high in certain parts of the world, the basic consumer needs of a large section of humanity are not being met. This results in excessive demands and unsustainable lifestyles among the richer segments, which places immense stress on the environment. The poorer segments, meanwhile, are unable to meet food, health care, shelter and educational needs. Changing consumption patterns will require a multi-pronged strategy focusing on demand, meeting the basic needs of the poor, and reducing wastage and the use of finite resources in the production process.

South Africa's self-adopted title of the "Rainbow Nation" indicates its unity in diversity. Unfortunately, this notion embraces not only the positive aspects of political and cultural pluralism but also the negative aspects of enormous economic inequality. South Africa is a world in one country in many respects, and the idea of excessive demands among rich segments of the world alongside the inability to achieve basic needs among the poorer segments is strongly represented within the borders of the country. In even the smallest towns one finds the level of disparity, which Agenda 21 points to on a global scale.

In the light of these disparities, Chapter 4 of Agenda 21 argues that the fundamentals of consumption and production patterns underlying the functioning of economic systems need to be reviewed and questioned in the search for sustainable development pathways. Agenda 21's conclusion is that achieving the goals of sustainable development may require "reorientation of existing production and consumption patterns that have developed in industrial societies and are in turn emulated in much of the world".

This book has begun to consider these questions in the context of South African industrial strategy. As a first toe in the water of environmentally sustainable industrial policy it is not a comprehensive review, nor does it purport to have developed all-embracing solutions. Hopefully, however, it does begin to address the exhortation from the same chapter of Agenda 21, that research institutions should "assess the relationship between production and consumption, environment, technological adaptation and innovation, economic growth and development, and demographic factors and ... consider how economies can grow and prosper while reducing the use of energy and materials and the production of harmful materials".

The chapters in this volume have primarily looked at the production side of this equation. Admittedly, this means that there has been almost no consideration of consumption issues. This is certainly a gap: consumer demand drives production, and aspirations of certain material lifestyles and levels of resource consumption are seldom questioned. Particularly in South Africa, burgeoning consumer expectations following the end of apartheid are seldom questioned. Yet, these issues need to be critically examined and openly debated. The consumption side of the equation, including demographic questions, should be taken further.

### A production-centered approach

Despite this and other gaps, the chapters in this book do provide a new look at the real questions of sustainable development, and the environmental management needed to get there. The industry-based approach lays the groundwork for examining where and how existing production patterns should be reorientated, and it does this in a way that is compatible with existing studies on production and industrial strategy more broadly. Whereas other studies look directly at the environment—and the various media such as air, soil and water—our starting point has been industrial policy. In this way we have begun to integrate environmental questions with industrial debates, rather than vice versa.

How, if at all, do the chapters in this volume provide a new look at sustainable production? The focus in this volume is not solely on assessing environmental damage, discuss-

ing new technological approaches or recommending new pollution control regulations; rather, the focus is on the question of how industry and its associated institutions need to change to meet sustainable development challenges.

The main attempt of the authors has been to consider the incorporation of environmental management into industrial strategy, rather than to consider how environmental management strategy can incorporate the industrial sector. This means that the focus of attention is largely on industry itself and the changes required there, and not on the broader requirements of environmental management. It has also meant a fairly international approach: two chapters focus explicitly on international trade and external environmental pressures. These chapters present clear indications that the attention of environmental management in industrialised countries is turning to production and consumption issues, and they analyse how these will affect South African industry.

There are many overlaps between a focus on industry and a focus on environmental management processes themselves, and the authors in this volume have not artificially confined themselves to only the former realm. Despite this, in its overall approach, the slant has been towards an examination of industrial production and industrial strategy, and this slant has provided some insights into new approaches that can be used to bring South Africa's industrial sector closer to a pathway of environmentally sustainable development.

As indicated, this volume does not hope to be comprehensive. The field—that of both the country's economic and natural resource base—is too vast to contemplate that. This means that key areas have been neglected. A number of important new concepts in, and their impacts on, industrial environmental management have not been addressed. These include ideas such as "design for the environment" and "industrial ecology". Further, certain economic sectors of vital significance to industrial behaviour have been ignored, an important one being the financial and insurance sector, which should receive greater attention.

## Characterising the failures

The research in the book leans towards broad examinations of key areas which determine the sustainability or otherwise of the industrial sector. To learn as much from these initial studies as possible—given the fact that they examine only the tip of the iceberg—it is necessary to generalise to a degree. The research has pointed out common problems or blockages to improving the environmental performance of South African industry. We discuss these characteristic failures below. We then go on to make recommendations in various areas. These attempt to bring notions of sustainable development within the ambit of industrial strategy in general, and within the context of a strategic state in particular.

### The failure to recognise and internalise externalities

The first broad failure is the inability of the South African economy to place the full value, including the social and environmental value, on industrial inputs and outputs. A key element in making the industrial sector sustainable is ensuring that environmental exter-

nalities are internalised within the cost functions of companies. This would be done through the application of the polluter-pays principle and through the environmentally "correct" pricing of the country's—and hence the economy's—natural capital. Although a range of instruments of industrial strategy and public policy can influence industry, the bottom line is that industry responds best to its economic context and, thus, the full cost of inputs and outputs should be reflected in their price. Two key inputs in this regard are energy and water; on the output side a range of polluting activities need to be explicitly valued and charged for.

As Van Horen shows, with reference to the external costs of electricity generation, the current cost estimation of this ubiquitous input excludes certain externalities. The external costs of air pollution alone are estimated to be in the region of 14% of electricity prices. Users of electricity, justifiably basing their use primarily on a cost basis, are thus basing their decisions on an artificially low price structure—artificial, because the health and environmental impacts of electricity generation are not included in the cost of their product. This makes a sustainable level of use of electricity highly unlikely in the industrial economy. A similar situation pertains to pollution, with a number of examples revealing that the sink (waste-receiving) functions of the environment are also undervalued.

The failure to incorporate externalities is not only due to inadequate environmental and economic policies, but also to regulatory failures. For example, in the small, medium- and micro-sized business sector many companies are not aware of effluent charges, or the environmental reasons for them, and are not adequately informed about them or made to comply by local authorities. Therefore, even though there is an instrument which goes some way towards meeting the polluter-pays principle—that is, effluent charges—it is not enforced and has little effect in certain sectors of industry. Staying within the SMME sector, Coleman provides a striking example of the potential use, and failure, of an economic instrument. She shows how the R8,50 (about US\$2) refundable deposit on car batteries has worked to increase the level of battery recycling, and also shows how easily it can fail to work when the deposit system breaks down.

This is a useful example of the value of economic instruments but it is also a cautionary tale. It points to the fact that economic instruments, such as those designed to address the polluter-pays principle, are only as effective as the integrity of the system set up to manage and enforce them. Often touted as administratively "easy" instruments to use, this example demonstrates that they, too, need solid administrative and regulatory supervision to be effective.

A further dimension is raised by the International Federation of Chemical, Energy and General Workers' Unions. As Coleman points out, the federation's analysis shows that a consequence of the underpricing of natural resources and of industrial pollution is a skewing of the relative costs of labour. Proper resource pricing would make it apparent that labour costs are comparatively less expensive when all externalities are taken into account. In the context of an industrial strategy and a macroeconomic policy that are both geared towards employment generation this is an important consideration. A policy that promotes more labour-intensive production, by the use of sound environmental and financial principles, should be seen as a first-best strategy choice.

However, this will not be easy to achieve. As Van Horen's study shows, getting to the "true" value of environmental externalities is not easy. We need better approaches to the assessment of external costs for energy in particular but other natural resources as well, especially scarce water resources. We also need a better understanding of the implications of the polluter-pays principle and other means of internalising externalities, and a deeper consideration of managing public sector responsibilities and instruments in this regard. The use of the market in this process is also unclear: what are the points of market failure and how can they be addressed with as little disruption as possible?

As Gibson and Van Seventer show in their modelling study, we must also be well-aware of the economic consequences of such strategies. They demonstrate that it is macroeconomically desirable to avoid green trade restrictions which are externally imposed by internalising environmental externalities. Taken together with Van Horen's study, the implication is that the South African economy has significant external costs. The choice is whether, and how, to make these costs apparent to the industrial economy and consumers.

### **Inadequate government regulation**

The studies in this volume are littered with examples of breakdowns in the regulatory system. As Lazarus discuss, South Africa is not short of environmental law as much as it is short of effectively wielded environmental law. The waste situation is a particularly good example, with insufficient personnel to carry out the enforcement of waste legislation and very minor penalties for conviction of an offence under the Environment Conservation Act, the most pertinent legislation. The situation is clearly in need of dramatic improvement. Despite the evidence in Goldblatt's chapter of the uncontrolled production and disposal of hazardous waste, Lazarus point out that there have been no convictions yet under the Environment Conservation Act.

Coleman shows that this ineffectual enforcement extends down to the smallest level of business, with clear evidence of illegal dumping of small businesses' hazardous waste by private contractors with a "no questions asked policy" on the destination of the waste, while Butler's case study on the Thor Chemicals debacle is a demonstration that things can go wrong at a much larger level—with tragic and long-lasting consequences. The Thor study shows the gaps, confusion and inadequacies of current legislation, enforcement and prosecution better than any theoretical study. The responsible authorities were simply not able to effectively protect workers, the public and the environment from damage and they were not able to effectively prosecute after the fact.

As discussed below, we need to seek innovative and cost-effective ways to improve this regulatory system, including economic instruments; government, industry, labour and community voluntary agreements; managed self-regulation and voluntary reductions; and better information provision. We also simply need larger, better-trained and better-resourced enforcement authorities with the political will to administer the law effectively. Alongside this is a need for the integration of environmental considerations with planning and industrial location decisions, discussed by Lazarus. We also need a policy and legislative environment conducive to certainty and to consistent enforcement.

On a similar note, we argue that the various arms of government are missing the opportunity to seize environmental opportunities. There is extensive scope within general institutional and policy restructuring underway at present to incorporate environmentally beneficial elements. One example of this is that government's increased support for the SMME sector could include environmental management support for SMMEs and assistance with finding environmental business opportunities at the small end of the industrial sector. SMMEs are a good example of the need to integrate environmental considerations into broader industrial strategy and policy. It is unlikely that environmental support can be maintained separately from other support services to industry on this scale, and, thus, it should be included in the general support being offered to SMMEs. Similarly, the development of new housing could be incorporating best-possible environmental features in order to avoid future costs.

### **Insufficient pressure from civil society**

The studies seem to indicate that unions and civil society are not sufficiently active or powerful to shore up weak government regulation. The Thor case is both a demonstration of the initially weak position of workers and unions in the absence of adequate information, and of the dramatic results that can be achieved when sufficient union and civil society pressure is applied. It also demonstrates the potential of alliance politics based on shared environmental concerns.

Furthermore, local consumer pressure was hardly raised as an issue in any of the chapters. This is probably indicative of an environmentally unaware or unconcerned public exerting a weak influence on industrial processes. However, local consumer pressure was not an issue explicitly looked at by any of the authors and may be underestimated or still developing. The experience of developed countries shows that direct pressure from end-consumers is a potent force driving industrial environmental improvements—whether and how it will arise locally is still unclear. Bethlehem's research does point to the importance of international consumer pressures being transmitted to local companies via market forces and indirectly via environmental regulations in South Africa's trading partners.

From a different angle, a number of chapters (such as Bethlehem, Butler and Lazarus have shown that many South African companies lack a serious environmental agenda. Environmental activities tend to be rearguard efforts, in response to prodding by the state, environmental groups or the international market. Very few South African companies place environmental performance at the centre of their strategic agenda, or innovate effectively in this regard. Too often environmental responsibilities are located in companies' risk assessment offices or in their marketing departments. This is in sharp contrast to international efforts which tend to place environmental responsibilities more centrally in each of the companies' activities, especially in production. A recent article illustrates this contrast.

The article (*The Star*, 24 October 1996) reviewed efforts by auto producers internationally to introduce environmental innovations, including reductions in fuel consumption, use of recycled and lighter materials and the search for alternative energy sources. Some South African companies interviewed for the article claimed to also be concerned

with the environment. As their contribution they cited the fact that they generate large quantities of recyclable materials, such as computer paper and plastic, in the course of running the business. A moment's consideration of this statement reveals that the company is claiming credit not for *reducing* resource consumption or introducing innovations, but merely for using resources which are recyclable. We are not even told whether the company in fact recycles its computer paper! But more to the point, the company is trying to utter a magic word—"recycling"—rather than pursue a serious environmental agenda. This kind of claim is shallow and relies on a poorly informed public. Ways need to be found to encourage South African companies to place environmental issues squarely on their production agendas, to invest appropriately and to develop the ability to innovate in this sphere. Various kinds of pressures and incentives can contribute to the process, including more active government involvement and growing pressures from local and international stakeholders. A greater supply of technically skilled environmental managers will also be needed.

### **Inadequate information**

A final broad failure of environmental management concerns the provision of adequate information to all the actors involved. As discussed already, information on the environmental costs of production, in the form of price signals, are largely missing from the economy. Explicit information is similarly absent. Goldblatt shows the dire situation in the waste sector where there is inadequate knowledge of the types, quantities and environmental pathways of pollutants released into the environment. There is also inadequate legal access for private citizens to the information that does exist, and inadequate compulsion on companies to collect and divulge improved data.

The right to know and the transparency of information are central tenets of a democracy and are particularly relevant to environmental matters where the issues at stake often have social implications. Those potentially affected by environmental externalities should have the right to know and to be informed about them. In particular, those most directly affected should have absolute rights to knowledge about possible environmental hazards. Workers, at the frontline of the hazards of production (as shown by Butler and Magane, are one such grouping who should have the right not only to know but to be informed.

Underlying many of the chapters is a sense of an inadequate information base on which to found decisions and devise industrial environmental strategies. This is an area that needs serious attention to ensure that satisfactory knowledge underpins environmental decisions and guides the setting of environmental priorities. Van Horen's research is a good example of the difficulties created by a paucity of environmental information. A number of the impacts of electricity generation could not be quantified and valued because of insufficient data. These included significant issues such as air and water pollution from coalmining, the acidification effects of coalburning and the water quality impacts of electricity generation. Good decisions depend on good information—unfortunately, the collection of policy-relevant information has not been well-integrated with the environmental management system at either a firm or a government level.

## Policy directions and recommendations

The various chapters of this book make recommendations for environmental policy and management. Here, we take another look at the major recommendations that are made and go on to a discussion of the more overall policy directions that arise from the research.

- There is a need to improve various aspects of environmental legislation, particularly that legislation which governs new industrial projects or expansions of existing production facilities. Appropriate legislation should provide a greater degree of certainty by establishing a predictable procedure for evaluating the environmental impact of a proposed project and deciding whether that project should be allowed to continue. There should also be a predictable mechanism for resolving disputes about proposed projects and well-defined timetables for doing so. In order to achieve these objectives, environmental impact assessments and other forms of environmental evaluation need to be fully incorporated in the planning procedures of industry, as well as in the local government decision-making processes.
- Eskom's overriding objective to be the cheapest supplier of electricity in the world should be evaluated in the context of the externalities discussed in Van Horen's chapter. In particular, Eskom should consider investments in environmental technologies given the demonstrated (hidden) costs of not making these investments. This would entail a pricing policy at Eskom that attempts to incorporate as many of the hidden costs of supply as possible, and a determined approach to reducing emissions at all Eskom's power stations, with special attention to air emissions, including particulate and oxides of sulphur. The externalities regarding human health are particularly important given the social and fiscal costs that these involve.
- The departments of Environmental Affairs and Tourism, Trade and Industry and Foreign Affairs should develop mechanisms to anticipate international environmental pressures and should respond appropriately. In particular, government, possibly with the assistance of the Industrial Development Corporation, should assist industries to adjust to international pressures where there are specific reasons why companies or sectors cannot make the adjustment successfully without intervention. In this regard, the Industrial Development Corporation should consider establishing a programme to provide finance for companies that are upgrading their capital equipment in order to improve their environmental performance.
- Government should play a more active role in negotiating international environmental agreements, standards and trade rules. While South Africa is already quite active with regard to multilateral environmental agreements, attention also needs to be given to more specific negotiations such as those in the World Trade Organisation and the International Standards Organisation. Government also needs stronger ways of working with business and, where appropriate, trade unions, in the course of these negotiations.
- South African provincial and national government authorities should establish environmental information systems, including pollution registers. This would make national environmental management easier and give the public access to information about ways in which industrial and other economic activities are affecting their

living space. These efforts should be coordinated by the Department of Environmental Affairs and Tourism and should draw on international expertise and financial assistance.

- The Department of Trade and Industry should extend its system of support for SMMEs by offering environmental support to such firms on a sectoral or area basis. Local governments in areas with large concentrations of SMMEs should provide facilities such as hazardous waste collection and disposal, as well as specific material recycling projects. Pilot projects should be set up as soon as possible.
- Trade unions should increasingly adopt a collective bargaining-based approach to health, safety and environment issues at the workplace. Rather than separating these issues and dealing with them in technical-type committees, unions should train shop stewards and organisers to deal effectively with these issues as part of their representative and negotiating work. The new trade union education organisation, Ditsela, should be encouraged to offer courses that empower worker representatives to take on these issues effectively.
- Workers should also be properly informed of the dangers associated with their work and of companies' health and safety obligations towards them. Workers should have the right to refuse unsafe work without risking their employment.
- Inspectors and environmental officers in the public service should receive better training and a greater understanding of the implications of their decisions. There should be greater integration between different government agencies in dealing with a single company.
- Companies should be required to produce an environmental audit providing information on the environmental impacts of their activities and the actions they are taking to control these. These should be made public and monitored by independent organisations.

The chapters themselves provide more detail on the recommendations in each area. Taken together, however, these chapters also suggest a larger agenda to ensure that more comprehensive and determined action is taken in industrial environmental management. Some of the chapters have suggested that there are too few pressures and incentives for all sections of industry to improve their environmental performance. But how does government go about ensuring that industry is managed in a more environmentally responsible manner and that improvements are made on a continuous basis? Do we promote more government controls, or should we favour self-regulation? Are there alternatives to these two approaches?

The history of Thor Chemicals suggests that even when government is actively involved in a particular case, its intervention will not necessarily be effective, especially where there is a high degree of discretion or where officials are not sufficiently trained. And then there are many more cases, which are less high-profile than Thor and about which the authorities have little or no information. The ability of the state to regulate the environmental impacts of all economic activity is obviously limited, and is especially limited in the South African context where the state is constrained in its access to material and human resources. But what does this suggest? Do we pursue a self-regulation approach which

puts much of the onus on industry to monitor its own performance? Can such an approach ensure that the public and the environment are adequately protected? To what extent can the players also be the referees? And, yet, industry's participation in the implementation of national policy is imperative. More than that, improvements in environmental management will be severely hampered if industry does not actively take the initiative. Industry has a number of key resources at its disposal, including information about the outcomes of its processes (or, at least, the potential to collect such information), skilled personnel (or the ability to attract them) and the in-depth knowledge of their own process of production that can lead to innovation. The question is: how can industry's resources and skills be mobilised for better environmental management? The approach that we adopt is one which sees legal and administrative regulation as a critical but limited tool, and which promotes a process of *partnership* between the public and private sectors. In this approach, regulation is seen as critical to establishing the parameters in which industry operates but as unlikely to promote the kinds of innovation and continuous learning that will result in long-term environmental improvements.

How would such a partnership approach be effected? We see a key tool being a series of sector-based agreements between industry and government on environmental goals in a particular sector. This is not a new idea, but rather one which is borrowed from experiences in a number of other countries, notably the USA and the Netherlands. We argue, however, that it is a mechanism which is particularly well-suited to South African conditions. The second and third suggestions are aimed at improving the capacity of the state to intervene creatively in environmental policy by integrating the various arms of government more effectively. These proposals are discussed below.

### Macro-level recommendations

- *Sector-level voluntary environmental agreements should be established in key industries*  
In Chapter 5, Goldblatt describes efforts that have been made in the USA to develop voluntary targets for emission reductions in each sector. These have been labelled 33/50 strategies because they start with targets of 33% reductions in particular emissions and move on to 50%. Similar efforts have been made in the Netherlands where government worked with key industries to identify and reduce specific types of environmental damage. These strategies have been highly successful in reducing particular types of pollution, and industry has often been able to reduce the emissions far beyond the original targets. The idea behind these agreements is to get industry and government to jointly identify the most serious environmental problems in a particular industrial sector, and then come up with a voluntary programme to address that problem. If, for example, particulate emissions are identified as the biggest problem, then companies come up with plans and timeframes to reduce those emissions. If lung disease among workers is a key problem, an action plan is drawn up in that regard. If hazardous waste is the key issue, a programme is defined in that regard. These targets do not replace existing regulations but rather aim to achieve outcomes that go beyond ordinary laws by creating a voluntary programme to address a particular problem.

Once the targets have been agreed, government plays a coordinating and monitoring role to ensure that the agreed targets are met. Government can also offer to publicise successes and may offer other incentives such as preferential finance for investment in appropriate technologies. As the particular targets are met, government and industry representatives are able to identify further issues to be tackled or further programmes of cooperation. Government may also be asked to improve aspects of its performance such as the quality of its inspectors.

In the South African context, it may be important to involve other stakeholders in identifying the problems that are to be addressed. Organised labour, community and environmental groups would often have strong interests in the way in which problems are identified and prioritised. Indeed, workers and communities are often aware of problems that management is not. However, it would be important to manage this process in a way that avoided creating an overwhelming list of demands by which industry feels besieged. If voluntary agreements are to work they must be focused enough to succeed in a relatively short period. It is in no one's interests to create overambitious targets or long shopping lists that ultimately cannot be achieved.

We believe that a series of voluntary environmental agreements (which include specific objectives and targets) would be useful in South Africa. The advantage of this type of partnership approach is that it supplements regulation but requires few government resources. The strategy also builds on strengths that South Africa already has, including strong tripartite traditions and experience in developing industry plans. Indeed, the Department of Trade and Industry is increasingly pursuing a sector-based approach to policy, as is seen in its current series of cluster studies. Sector-based environmental agreements would take that approach further.

It is unclear exactly who should coordinate such efforts, but the departments of Environmental Affairs and Tourism, Trade and Industry and Water Affairs and Forestry would certainly have to be central. Indeed, a joint project could be developed between all three departments. On the private sector side, there is already an institution which represents industrial environmental managers in the form of the Industrial Environmental Forum, and there are also numerous sector-based employer bodies which could act as effective partners for such a programme. In order for such agreements to work, however, government would have to have a clear idea of which problems it would like to address in a particular sector, so that it can negotiate effectively with industry. In developing such positions, government could draw on its own inspectors and officials in the various departments, and could gather the views of trade unions and environmental groups. Specific research could also be commissioned.

Government would also need a champion to drive the process and dedicated government officials to coordinate and drive the process. It is also possible that these agreements could be initiated at the provincial level.

- ***Greater coordination needs to be achieved between various national departments dealing with industrial environmental policy***

There are presently a number of medium-term initiatives to ensure greater integration of government's environmental activities. One of these is the integrated pollu-

tion control process which will make recommendations aimed at integrating aspects of environmental regulation and administration. There have also been various interdepartmental working groups over the years which have focused on broad environmental policy. Despite these efforts there is a serious lack of coordination as well as a lack of focus on the specific environmental problems of *industry*. In this regard it would be useful to set up an interdepartmental working group to coordinate industrial environmental policy specifically. The key departments in such a working group would be the departments of Environmental Affairs and Tourism, Water Affairs and Forestry and Trade and Industry. Other departments might also need to be incorporated, including Health, Labour, Land and Agriculture and Foreign Affairs. In order to be effective, such a committee would have to operate at a senior level, which may involve, for example, regular meetings of appropriate chief directors.

- ***Cooperation should be fostered between national and local governments and between different local governments operating in heavily industrialised areas***

The national committee described above would assist with coordination at the *national policy* level. But there is a second problem—the *implementation* of policy—which mostly happens at the local, regional and provincial level. In this regard coordination is required between the various tiers of government, specifically the national and local levels. Although it is local governments that are involved in the day-to-day implementation of industrial environmental policy, there is too little coordination between local governments themselves, or between local governments and national departments. One way to address this would be to identify key local governments that operate in heavily industrialised areas, and to set up a network between them. Such a network would aim to improve the capacity of local governments to deal with the specific problems of industry's impact on the environment. Through the network local governments that deal with industry could share experiences, arrange training and cooperate with the national departmental committee suggested above. The network could also engage in a series of capacity-building initiatives in cooperation with the national departments. Such government cooperation could allow key local governments to influence national policy and implement policy better.

### **Conclusion: Towards a focus on industry and the environment**

This volume has addressed a number of key areas in the industry and environment debate. However, this work only goes a short way towards answering the complex questions that are involved in promoting an environmentally sustainable industrial sector. We hope that this book will, however, promote a specific policy focus on industry's environmental impact as distinct from other aspects of environmental policy. A focus on industry and environment could help to encourage further research, more active policy formulation and more determined approaches to the management of industry's environmental impact.