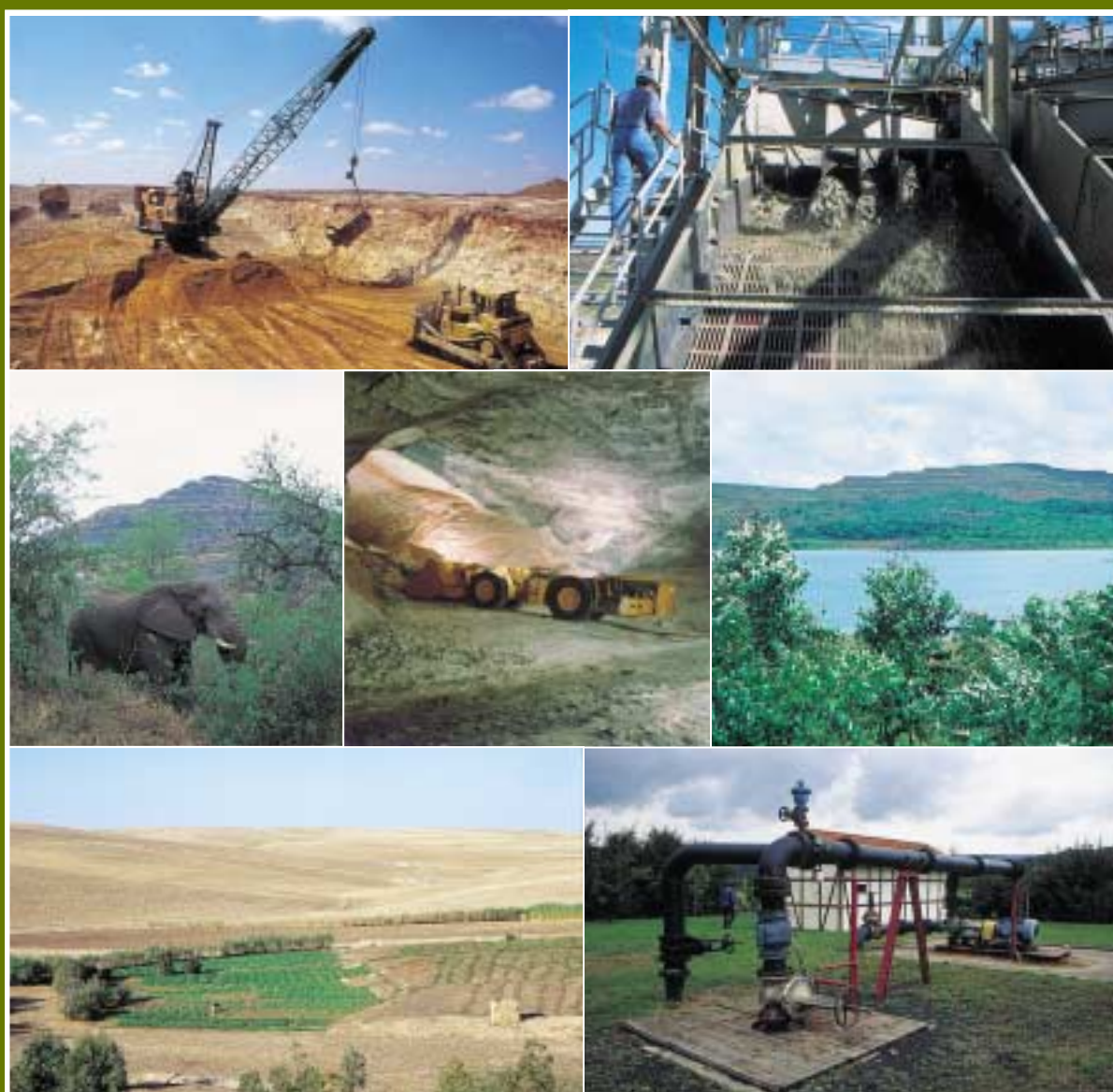




Environmental Aspects of Phosphate and Potash Mining

United Nations Environment Programme
International Fertilizer Industry Association



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Preface

This report on the environmental aspects of phosphate and potash mining is the fifth in a series published jointly by the International Fertilizer Industry Association (IFA) and the United Nations Environment Programme (UNEP). Previous studies included :

- The Fertilizer Industry, World Food Supplies and the Environment;
- Mineral Fertilizer Production and the Environment;
- Mineral Fertilizer Distribution and the Environment, and
- Mineral Fertilizer Use and the Environment.

As such, this publication completes a series that looks at environmental aspects of the fertilizer industry throughout the life-cycle of mineral fertilizer products. In this volume, the holistic way of looking at an issue is applied to the activities of the fertilizer raw materials sector, incorporating the concept of the whole-of-mine-life thinking and planning.

Chapter 1 is an introduction to environmental issues associated with mining phosphate and potash ores.

Chapter 2 gives an overview of the processes involved in extracting these minerals and preparing them for fertilizer production. Chapter 3, the focus of the document, looks at some of the industry's responses to associated environmental challenges. Finally, Chapter 4 considers how the mining sector might best contribute to the sustainability of the overall fertilizer industry in years to come.

The study reinforces the fact that the environmental performance of the fertilizer raw materials industry has improved over recent decades, although challenges remain. This publication therefore, explores the variety of approaches and techniques which are being used in different parts of the world to address environmental concerns.

It is our sincere hope that, not only will this report prove useful, but that companies will continue to strive to achieve ever cleaner and safer production as part of their ongoing efforts to contribute to sustainable development.

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1. Introduction

1.1 The Mining of Phosphate Rock and Potash and the Environment

Fertilizers are a key factor in sustaining the world's agricultural output. They supply nutrients that are needed by all plants for normal growth, development and health. Maintaining an adequate supply of food for human consumption requires:

- A supplementary source of plant nutrients if the natural supply is insufficient.
- Replacement of the many possible nutrient losses.

These replacement and/or supplementary supplies can be provided through organic manures and/or mineral fertilizers.

This publication concerns the provision of raw materials for two important mineral fertilizers, phosphate and potash.

Three major nutrients are required in large quantities for plant growth, nitrogen, phosphorous and potassium. Three secondary nutrients are required in smaller quantities on some soils; sulfur, calcium and magnesium. Seven micronutrients may be required in small amounts where deficient. Each nutrient has a specific biological function and, while there may be synergies between the nutrients, none has a substitute.

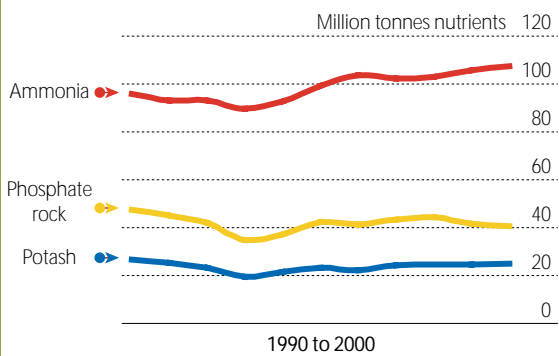
By far the most important for the present publication, in terms of the quantity mined and potential impact on the environment, are phosphate and potash.

The production of phosphorous and potassium mineral fertilizers relies essentially on the mining of mineral concentrations, in the form of ore deposits from the earth's crust. Nitrogen mineral fertilizers, on the other hand, are almost entirely based on ammonia manufactured from the abundant source of atmospheric nitrogen, water and energy.

The production of nitrogen fertilizers has been discussed extensively in the earlier publication by UNEP/UNIDO/IFA on 'Mineral Fertilizer Production and the Environment: Part 1 - The Fertilizer Industry's Manufacturing Processes and Environmental Issues' and will not be covered further here.

World production of phosphorous and potassium mineral fertilizers in 1998/99 was 34 Mt P₂O₅ (1) and

Figure 1.1
World mineral fertilizer production



25.5 Mt K₂O respectively. This required the extraction of 144 Mt of phosphate rock and more than 45 Mt of potash ore (2). Table 1.1 indicates the scale of the mineral fertilizer raw material mining industry in comparison to the mining of other bulk mineral and energy commodities.

Table 1.1.
Comparison of the World Production of Some Bulk Minerals in 1998/99

Product	Tonnage
Coal	4,655,000,000
Iron Ore	1,020,000,000
Salt	186,000,000
Phosphate Rock	144,000,000
Bauxite	126,000,000
Gypsum	107,000,000
Potash Ore (2)	45,000,000

(1) Phosphate and potash may be expressed as their elemental forms P and K, or as oxide forms P₂O₅ and K₂O. In this publication the oxide form is used.

Mt = million tonnes

(3) In KCl equivalent (sylvinite). Actual tonnages are larger, including kieserite, langbeinite and carnallite ore.

During recent decades, attention and concern has been focused increasingly on the environmental impacts of human activities, especially industrial activities such as mining. The public perception of the mining industry has been tainted by a legacy of environmental damage from past practices combined with a number of highly publicized failures of metal mining tailings dams. As the scale of operations and the area disturbed by the mining industry continue to grow, so too has the public's concern over the industry's capacity to manage and mitigate environmental impacts. In response, most governments have imposed stricter legislative and regulatory requirements on the mining industry in order to protect the ecosystem, to maintain a safe and secure environment and to protect people living in the vicinity of the mine-site.

Leading mining companies have taken up the challenge and are pushing beyond minimum legal requirements through voluntary initiatives, to ensure their continued "license-to-operate" from the community as well as increasing their competitive advantage through continuous, voluntary improvements in environmental performance.

As with all mining activities, the extraction and beneficiation of phosphate rock and potash to produce mineral fertilizer raw material has the potential to cause environmental impacts. These impacts can take the form of changes to the landscape, water contamination, excessive water consumption and air pollution.

The landscape may be disturbed through the removal of topsoil and vegetation, excavation and deposition of overburden, disposal of processing wastes and underground mining induced surface subsidence.

responded to the challenges presented by the changing environmental, political and cultural values of society, through an overview of the industry's environmental performance worldwide. Information on company environmental practices has been gathered from an extensive series of site visits to fertilizer raw material mining, beneficiation, and processing operations, in addition to a review of available literature. The companies and organizations involved in the project are listed in Appendix B. While this does not provide a complete picture of the current state of the industry, it does demonstrate the direction of development, and the range of systems, practices and technologies employed.

The publication focuses on the environmental aspects associated with the mining of raw materials for the manufacture of phosphorous and potassium mineral fertilizers. Earlier joint publications by UNEP, UNIDO and IFA have covered the environmental issues associated with the downstream processing, distribution and use of mineral fertilizers (3).

1.2 The Global Environment Agenda and the Mining Industry

Environmental impact is an increasingly important issue against which human activities must be weighed. A key factor is the scale of natural resource consumption, such as that of minerals, agricultural land, wood and fisheries.

The issue of resource consumption requires that the causal factors be addressed, such as:

- The continued world population growth;
- The material consumption patterns of the developed world, which are increasingly being adopted

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