

Green Pages

Preface to: *Mining and its Environmental Impact*

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The quality of life in many countries of both the developed and the developing world is strongly affected by the products and processes of mining industries. The first Issue in this new series brings together a set of review articles by leading authorities in the field which, taken together, provide a thorough and detailed survey of many of the key topics of current concern relating to the environmental impact of mining. The level of treatment of most topics is at first introductory but evolves through to the advanced level of current research, backed up by extensive citations of relevant primary literature and other sources. Thus the Issue as a whole will be found equally valuable by students of environmental science and those actively engaged in research related to this theme.

The first article, by A.K. Barbour, provides an overview of non-ferrous metals mining, stressing the importance to modern society of the extractive industries. This touches upon extraction, concentration processes, and environmental impact assessment. The legislative framework is examined and the concept of 'Best Available Technology Not Entailing Excessive Cost' (BATNEEC) is introduced. While the focus of this first article is clearly on the extraction and concentration of non-ferrous metals and the associated environmental impacts, references is also made to the management of emissions from smelting, to recycling, and to issues associated with the high power requirements of these industries.

Fascinating insights into the many societal and technical concerns associated with gold mining in the Brazilian Amazon are provided by D. Cleary and I. Thornton in the second article. Informal sector mines (garimpos) account for more than 80% of Brazil's gold production, yet it is the world's fourth largest producer. Major environmental impacts result from the extensive use of mercury and the turbidity of rivers resulting from mining operations. This review points out that gold mining is not an important cause of deforestation in the Brazilian Amazon but that the high growth rate of malaria among the local Indian populace is attributable to the mining activity.

The revegetation of metalliferous wastes and land after metal-mining is reviewed by M.S. Johnson, J.A. Cooke, and J.K.W. Stevenson. Many metals, e.g. copper and zinc, are essential trace elements at low concentration but become toxic to plants at high concentration, while others, such as lead and mercury, are highly toxic to animals that may grace on the plants. The high acidity and salinity characteristics of mining waste leachates also inhibit plant growth. This article examines the problems and possible solutions related to the improvement of growing conditions and long-term maintenance strategies.

Related issues associated with vegetative remediation at Superfund sites—sites in the USA designated as in urgent need of remedial action after mining—are examined by G.M. Pierzynski, J.L. Schnoor, M.K. Banks, J.C. Tracy, L.A. Licht, and L.E. Erickson. Their article focuses mainly on sites in South Dakota and Kansas. The first is a former gold mining area, where arsenic and cadmium are the principal concerns, and the other is a site where lead and zinc sulfide ores were mined and smelted over a long period of time. The chemical and microbiological aspects of metal-contaminated soils are

considered and a model which forms the basis for practical methods of remediation is presented.

D.J. Buchanan and D. Brenkley of the British Coal Corporation review a wide range of issues related to coal mining, including the business environment in which coal must compete, methods of surface and underground production, and current practices to mitigate environmental impact. Their article draws attention to the imperative requirements of controlling the underground workplace environment as well as surveying the rôle of automation and process control, and current and envisaged novel resource exploitation technologies. This is set in an international context but exemplifies UK practice.

The associated problem of methane emissions from coal mining is examined by A. Williams and C. Mitchell. Their article looks at world production in relation to the importance of methane as a greenhouse gas. Knowledge about the emission sources is analysed in terms of three methods of estimation: the Global Average, the Basin or Country Average, and the Mine Specific method. Emissions from both active and abandoned deep mines as well as from surface and post-mining activities are totalled and the technical options for emissions control are evaluated.

Methods for constructing ecosystems and determining their connectivity to the larger ecological landscape are reviewed by J. Cairns, Jr. and R.B. Atkinson. They examine the impact of the 1977 Surface Mining Control and Reclamation Act in the USA which led to careful grading, ditching, and removal of sediment ponds, resulting in rapid dewatering of contour surface mined areas. Their article focuses on recent studies of wetlands in such areas and their design features which relate to industry reclamation needs and regulatory constraints.

The issue of drainage and discharge of polluted water from both active and abandoned mines is examined by R.J. Pentreath of the UK National Rivers Authority. Such water commonly is of high acidity and salinity; iron salts, generating colour in the form of trihydroxide, constitute a particular problem. Abandoned mines are highlighted: when pumping stops, mines often flood and contamination then enters groundwater and water courses. The legal position is unsatisfactory, as illustrated by the Wheal Jane incident in 1992 when an abandoned tin mine in Cornwall, UK caused extensive local pollution. The involvement of government agencies in control and remediation measures is described, with other examples drawn from both coal and metals and minerals mining.

Finally, in a review with policy issues and environmental best-practice in metals production, A. Warhurst makes a case for an approach which defines regulatory goals and introduces an informed technology policy. This provides a planning tool to enable regulators to determined optimal corporate environmental trajectories in relation to economic competitiveness and environmental compliance. A number of case studies are outlined with some emphasis on the economic and political considerations.

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