

SMI Knowledge Transfer presents an ACMER Short Course on 'The Fundamentals of Good Mine Rehabilitation – Achieving Better Outcomes' 29-31 July 2009 Charters Towers, Queensland

Wednesday 29th July

Mining Industry Setting and Challenges

- Compliance with legislation
- Social Licence to Operate

Business Case for Good Practice Rehabilitation

- Compliance with legislation/licence commitments
- Assess effectiveness of environmental management
- Best practice as the basis for decision making

Regulatory Perspectives on Current Mine Rehabilitation

- Compliance with legislation/licence commitments
- Environmental protection act
- Monitoring rehabilitation in mining and extractive industries
- Other key monitoring and reporting issues

Life of Mine Planning

- Objectives of planning
- Benefits of planning
- Planning during mining project phases (exploration, feasibility, etc.).

Characterisation of Soils, Overburden and Wastes

- Reasons for characterization
- Timing of characterization
- Sampling of soils
- Sampling of overburden
- Sampling of other materials
- Characterisation of physical properties
- Characterisation of chemical properties
- Characterisation of microbial properties

Practical Perspectives of Mine Closure Planning

- Importance and role of vision and objectives,
- Integration of rehabilitation planning with risk assessment,
- Short, medium and long term rehabilitation planning, work programs, review of past success/failure, incorporation of new information into planning, refinement of completion criteria;
- the continual improvement loop;
- post closure monitoring and maintenance

Mined Landform and Drainage Design Principles

- Details to be confirmed

Influence of Climate on Closure Designs

- Three practical case histories of closed mine sites with open pits
- Golden Cross NZ – High rainfall
- Sleeper, USA – Low rainfall
- Kori Kollo, Bolivia – Moderate rainfall

Thursday 30 July

Development of Sustainable Ecosystems - Construction of Root Zone through Selective Handling of Materials

- Potential post-mining land uses and requirements for each
- Reasons for selective handling
- Necessity for soil retention
- Selection of horizons for stripping
- Stockpiling and its effects
- Optimum depth of replaced soil for different land uses
- Issues regarding the handling of soil
- Selective handling of overburden for creation of root zone and protection of water quality
- Selective handling of materials to create covers
- Examples of cover design

Ecosystem Establishment – Planning and Preparation

Good planning and preparation are essential elements of leading practice rehabilitation programs. This stage of the rehabilitation program should include:

- Obtaining the baseline information (e.g. on vegetation, soils) necessary to develop a workable rehabilitation program;
- Setting rehabilitation objectives based on the final land use plan, with stakeholder consultation;
- Developing a detailed revegetation plan to guide operations;
- Conducting the necessary earthworks, including erosion control and ripping;
- Developing a topsoil management plan;
- Ensuring that the required seed is collected, stored and treated to maximise its viability and germination; and
- Ensuring that any seedlings, cuttings etc. are available when required.

Mt Leyshon Field Visit

Technical summary of Mt Leyshon Closure Program

- Introduction to the history of operations
- Sources of data to characterise the site
- Importance of retaining operating and monitoring data
- Surface water quality at Mt Leyshon
- Groundwater quality at Mt Leyshon
- Geochemical characterisation of facilities at Mt Leyshon
- Future Options - Questions and Discussion

Questions and Discussion from the Couch

Friday 31st July

In most cases, rehabilitation should not be an 'end of mine life' operation. Where possible, opportunities for progressive rehabilitation should be sought and planned into mining operations. This provides valuable learning experience and reduces the impact footprint at any point in time.

Ecosystem Establishment – Rehabilitation Operations

Good rehabilitation outcomes require careful control over all operations, specifically:

- Good topsoil management including stripping and re-spreading at depths that will maximise retention of seed, nutrients and soil organic matter;
- Direct return of topsoil where possible; if not, aim to stockpile over dry periods and minimise the height of stockpiles;
- Weed control and minimising the introduction of weeds;
- Determining whether it is preferable to use seeding, planting, hydroseeding and/or transplanting;
- Addressing the needs of fauna by considering specific techniques such as the use of mulch, log piles, stags, hollows and transplanting grasstrees to ensure recolonization of particular key species within a reasonable time frame.
- Utilising specialised techniques to ensure successful rehabilitation of wetlands, tailings dams and areas disturbed in the course of exploration.

Alcoa's rehabilitation following bauxite mining in the jarrah forest of Western Australia is widely recognized as being amongst the world's best practice. This presentation illustrates the rehabilitation procedures used, and outlines how they have evolved over 30 years through research and a commitment to 'doing the job right'.

Case Studies on Establishment on Waste Rock Dumps and Tailings

(1) Case Study on Rehabilitation of Ranger Uranium Mine

- Key elements of ERA's Closure Model
- Important considerations in the design of the Ranger Final Landform (including cultural criteria)
- Revegetation strategy
- Recent construction of a 8ha trial landform (testing revegetation and cover design approaches)
- Closure criteria working group (ERA and s/holders)

Vegetation Management, Maintenance and Monitoring

All rehabilitated mined land will require management, even following mine closure. The extent of management required will vary depending on the selected land use, rehabilitation objectives, and site-specific factors such as landform, soils and vegetation. Defining what needs to be done, and who is responsible for doing it, are key components of any mine closure process. Responsibility for post-mine closure management will depend on what needs doing, who owns the land and is responsible for managing it, and any legal aspects, e.g. safety liabilities. These issues should be considered as early as possible in the life of the mining operation.

The design and implementation of a best practice rehabilitation monitoring program will be described by explaining the following key aspects:

- Clearly defining the purpose of monitoring;

- Monitoring in the different stages of a mining operation: baseline, operations, initial rehabilitation establishment, long-term rehabilitation performance, and post-closure;
- Determining what to monitor, selecting key indicators;
- Correct design of monitoring programs;
- Selecting the monitoring technique – mapping, conventional monitoring and Ecosystem Function Analysis;
- Data analysis and interpretation;
- Dealing with problems that may arise

Examples of monitoring programs used by companies operating in arid areas (Hamersley Iron), and in a sub-tropical coastal environment (Consolidated Rutile) will be presented to illustrate the recommended procedures.

Development of Appropriate Completion Criteria

Mining companies are increasingly aiming to establish sustainable native ecosystems following mining. How will they, the regulators and other stakeholders decide when this rehabilitation has been ‘successful’? Several mining companies and related research projects in WA and Queensland have made significant progress in coming to terms with this difficult topic. Using relevant examples, the following aspects will be explained:

- How to develop clear, measurable rehabilitation objectives;
- The use of reference, or analogue sites in developing targets;
- The use of an iterative process to measure rehabilitation performance and set achievable criteria based on what can be achieved using best practice;
- Assessing long-term sustainability;
- Dealing with older ‘historic legacy’ rehabilitation using a risk-based approach; and
- Addressing post-relinquishment management and monitoring requirements.

Industry Perspectives on Development of Appropriate Completion Criteria

Getting into the detail of rehabilitation planning and implementation; eg.

- communicating the vision and objectives;
- role of the Risk Register;
- prioritising control measures;
- budgets;
- adjusting to changes;
- studies, investigations, R&D and monitoring programs;
- procedures (writing and reviewing);
- spatial data management/GIS;
- documentation of what has been done and learnt;
- training & workforce education;
- consultation;
- stakeholder input;
- review of regulatory expectations;
- updating records/databases;
- development of quantitative completion criteria;
- auditing and other aspects of continual improvement.