

# Clear Solutions

No. 1/2010

[www.earthsystems.com.au](http://www.earthsystems.com.au)

Welcome to **Clear Solutions**. A newsletter produced by Earth Systems that explores up-to-date water treatment issues, solutions and technologies. We encourage you to provide feedback on its contents and suggestions for future issues.

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## About Earth Systems

Earth Systems is a global environmental consulting group, providing a wide range of services to industry, government and non-government organisations. Our focus is environment, water and sustainability. We have developed and implemented water management strategies since 1993. We provide:

- Specialist water quality advice
- Monitoring, data assessment and management
- Integrated water treatment systems
- Equipment service and maintenance
- Contract treatment

Earth Systems has developed innovative treatment technologies that can be packaged into a range of integrated water treatment systems suitable for use by industry, water authorities, mine sites and other remote locations. Our team includes more than forty professional staff and associates worldwide.

Earth Systems has worked in more than 15 countries and offers consulting and management services in the water, wastewater, mining, solid waste, environmental data and environmental research fields world wide.

[www.earthsystems.com.au](http://www.earthsystems.com.au)  
[WaterQuality@earthsystems.com.au](mailto:WaterQuality@earthsystems.com.au)

## In Focus: Acid and Metalliferous Drainage

Acid and metalliferous drainage (AMD) is one of the greatest challenges facing the global mining industry today, and poses a significant threat to the productivity and viability of the agricultural sector.

AMD is caused by the exposure of sulfide bearing geologic materials (eg. Pyrite -  $\text{FeS}_2$ ), to atmospheric oxygen and water. AMD is commonly associated with activities such as mining, agricultural and urban development. The oxidation of some sulfide minerals generates acid which in turn increases the dissolution of other minerals producing not only acidic but metalliferous drainage.

In some environments there are naturally occurring neutralising minerals such as limestone (calcium carbonate). These can neutralise the acid but may have little effect on some dissolved metal concentrations. The result is a near-neutral but metalliferous drainage with elevated salinity (sulfate) levels.

AMD generation can result in extreme and long-lived water pollution issues (eg. up to 2,000 years), affecting ecosystems, human health and other beneficial uses of surface and groundwater resources. Experience shows that dealing with AMD can be a costly, long-term problem if not managed correctly.

Key to the management of AMD is the accurate assessment, characterisation and classification of potentially AMD forming materials. Once this has been undertaken appropriate minimisation, control and, if required, treatment measures can be identified and implemented. The latest services and technologies developed by Earth Systems to assist in every stage of the AMD management process are outlined in the following sections.

## AMD Audit:

An initial assessment of all potential AMD sources and associated water quality hazards is one of the first steps at any site in minimising the long-term risks of AMD. These initial assessments are undertaken as part of an AMD Audit which can provide direction and assistance in determining what action is required.

Earth Systems has developed an **AMD Audit procedure** that is tailored to assess each stage of the AMD management process (from feasibility to closure) and can be applied to any site. The audit procedure includes the identification and quantification of potential AMD sources and hazards, and an AMD Management Systems Audit is undertaken to provide practical steps to assist an organisation in its AMD decision making processes. The audit process utilises in-house software and incorporates a two-day site visit, with a report being submitted on completion of the site visit, to provide an organisation with rapid feedback and a site specific assessment.

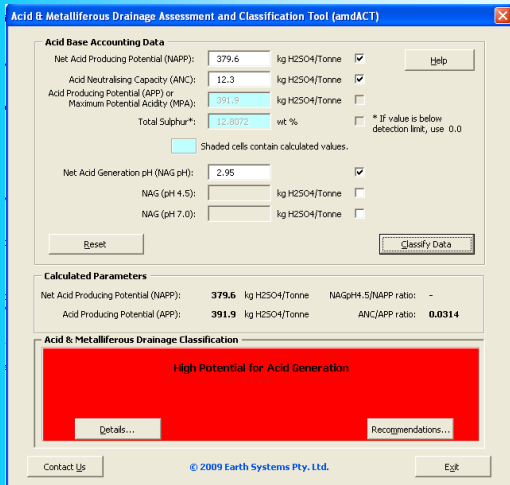
*For further information on Earth Systems new AMD audit service, please call or email Dr Marilena Stimpfl on 61-2-8006 2202 or [marilena.stimpfl@earthsystems.com.au](mailto:marilena.stimpfl@earthsystems.com.au).*



**Want to download AMDact?**

AMDact Version 1.1 will be available shortly for free download for Earth Systems clients from:

[www.earthsystems.com.au/tools.htm](http://www.earthsystems.com.au/tools.htm)



Screenshot of AMDact software.

**AMD Characterisation — Static Testwork:**

Assessing the AMD generating potential of ore, waste rock, tailings and wallrock can be complex and involves the interpretation of one or more static (eg. acid-based accounting) and kinetic tests. Interpretation of this data requires detailed knowledge of the tests and their limitations. In addition, some test results may be ambiguous and require additional testwork to draw valid conclusions.

To aid in the classification of various geologic materials as either potentially acid forming, non acid forming or acid neutralising, Earth Systems has developed the **Acid & Metalliferous Drainage Assessment and Classification Tool (AMDact)**. This Excel™-based tool uses the results from commonly performed static test work and geochemical analyses to provide an assessment and classification based on threshold values developed over years of experience assessing static ABA data. AMDact uses input from one or more of the following static tests and geochemical analyses:

- Acid Producing Potential (APP) or Maximum Potential Acidity (MPA).
- Acid Neutralising Capacity (ANC).
- Total Sulfur Content.
- Net Acid Producing Potential (NAPP).
- Oxidation pH or Net Acid Generation pH (NAG<sub>pH</sub>).
- Net Acid Generation to pH 4.5 (NAG<sub>pH4.5</sub>).
- Net Acid Generation to pH 7.0 (NAG<sub>pH7.0</sub>).



The tool allows rapid and consistent classification of sample data that can be used in assessing potential risks and the development of appropriate strategies for risk minimisation and remediation.

For further information on Earth Systems' AMDact tool, please call or email Mr Nic Bourgeot on 61-3-9205 9515 or [nic.bourgeot@earthsystems.com.au](mailto:nic.bourgeot@earthsystems.com.au).

**Advantages of OxCon include:**

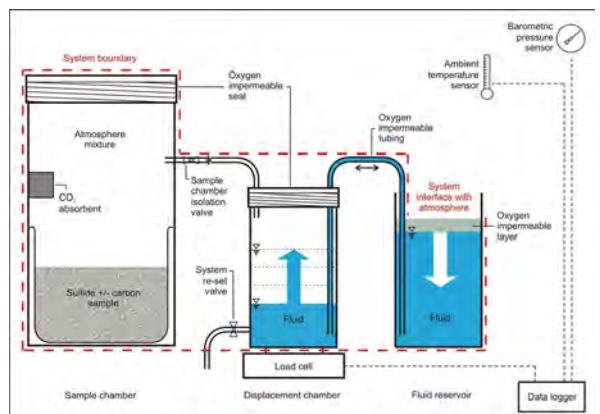
- **Low cost** (relative to other methods).
- **Fast determination** of sulfide mineral oxidation rates (2-6 months as opposed to 6-24 months for column leach tests).
- Simultaneous but independent **organic carbon oxidation rate** can be determined.
- Measures **sulfide oxidation rates** as a function of **oxygen concentration** and/or sample **moisture content**
- Measures **oxidation rates directly**, rather than inferences based on leachate sulfate concentrations.
- **Can be used on a wide range of material types**, such as waste rock / overburden, tailings, acid sulfate soils.
- **Tests can be conducted on or off site** with small sample sizes (<10 kg).
- **Many tests can be conducted simultaneously**.

**AMD Characterisation — Kinetic Testwork:**

Over the past 24 months, Earth Systems has developed the **OxCon (Oxygen Consumption) Method**, a new kinetic testwork technique for estimating sulfide mineral oxidation rates.

Knowledge of the sulfide oxidation rates permits determination of pollutant generation rates from sulfidic materials. With **OxCon** modules, sulfide mineral oxidation rates can be determined much faster, more accurately and at lower cost than traditional kinetic test methods (eg. column leach tests; humidity cells).

OxCon works by measuring oxygen consumption directly during sulfide oxidation. The apparatus shown above is used to collect data relating to oxygen consumption and other parameters that affect the test (including ambient temperature and atmospheric pressure). Proprietary software is used for data analysis.



The use of OxCon Modules to gather kinetic test data can lead to more effective AMD management at all stages of project development from the pre-feasibility / exploration phase and construction / operation phase to mine closure and rehabilitation.

For further information on the OxCon Method, please call or email Dr. Jeff Taylor on 61-3-9205 9515 or [jeff.taylor@earthsystems.com.au](mailto:jeff.taylor@earthsystems.com.au).



### Want more information?

For more help with understanding your water quality issues contact us on:

(61-3) 9205 9515

Or by email at:

[WaterQuality@earthsystems.com.au](mailto:WaterQuality@earthsystems.com.au)

For a copy of the latest publications on alkalinity producing covers, including:

*Alkalinity producing cover materials for providing sustained improvement in water quality from waste rock piles*, Paper submitted for the 2006, 7th ICARD.

*Alkalinity generating cover materials for lowering acidity loads from waste rock piles – field demonstration*, Paper submitted for the 2009, 8th ICARD.

Visit the Earth Systems downloads site at:

[www.earthsystems.com.au/tools.htm](http://www.earthsystems.com.au/tools.htm)

Or email Earth Systems at:

[WaterQuality@earthsystems.com.au](mailto:WaterQuality@earthsystems.com.au)

## Minimisation and Control:

**Alkalinity producing covers** are an AMD minimisation technology used to reduce the acidity load discharged from mining waste rock piles.

One such technology developed by Earth Systems involves the strategic placement of suitable alkalinity producing materials (eg. AcidBLOCK or specialized forms of precipitated calcium carbonate) in conjunction with engineered covers overlying sulfide-bearing waste rock piles. Rainwater infiltrating the waste rock pile transports alkalinity derived from the cover down into the sulfidic waste. Acid neutralisation reactions facilitate the formation of precipitates that coat sulfide grains and line preferential fluid pathways. These precipitates reduce the interaction between sulfidic materials and infiltrating waters resulting in decreases in acidity load discharges.



*Alkalinity producing cover field demonstration at a mine site in South Australia.*

Specially constructed alkalinity covers are being tested in a field-demonstration (designed and implemented by Earth Systems) at a mine site in South Australia.

The results of the demonstration confirm the ability of specialized alkalinity producing covers to substantially lower acidity discharges from sulfidic waste rock. Further testwork is planned to assess the potential of such covers to manage acidity discharges from Tailings Storage facilities.

*For further information on alkalinity producing covers and the management of AMD in waste rock piles, please call or email Dr Marilena Stimpfl on 61-2-8006 2202 or [marilena.stimpfl@earthsystems.com.au](mailto:marilena.stimpfl@earthsystems.com.au).*

## Treatment Solutions:

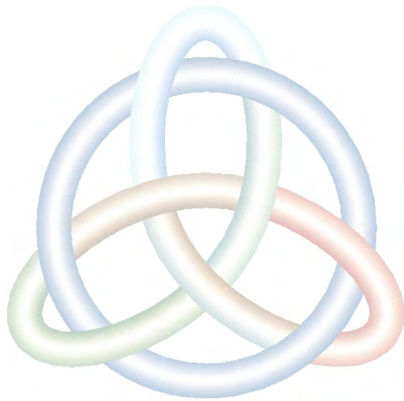
The **NeutraMill RapidTREAT system** is a reagent mixing and dosing system developed by Earth Systems to treat a wide range of mine or construction site water quality issues, including AMD, pH, turbidity, nutrient / algal pollution, elevated dissolved metals, cyanide and salinity.

The RapidTREAT systems are portable, self-contained skid mounted units that can be mounted on a flat-bed truck. This provides flexibility for mine sites with difficult access, and permits a single system to be used at multiple locations. With the capability of mixing and dispensing a variety of dry powdered reagents these systems are suitable for a wide range of water treatment applications on small and large water bodies.



For further information on the NeutraMill RapidTREAT system, or any of Earth Systems other mine or construction site water treatment systems, please call or email Dr. Jeff Taylor on 61-3-9205 9515 or [jeff.taylor@earthsystems.com.au](mailto:jeff.taylor@earthsystems.com.au).





## Leading Practice Sustainable Development in Mining Handbooks – updates

The Department of Resources, Energy and Tourism (DRET) is overseeing a revision of the *Leading Practice Sustainable Development in Mining* handbook series. Known as the **Leading Practice Sustainable Development Program for the Mining Industry**, the majority of the new handbook series is available now.

In addition to co-authoring the 'Managing AMD' handbook, Dr Jeff Taylor and Ms Sophie Pape of Earth Systems contributed to the 'Water Management' handbook released in May 2008, while Sophie Pape contributed to the 'Evaluating Performance: Monitoring and Auditing' handbook released in October 2009.

Many of these handbooks are available in different languages including Chinese, Korean, Bahasa Indonesian, Spanish, Vietnamese and Japanese. Visit the DRET website (<http://www.ret.gov.au/sdmining>) or contact Ms Sophie Pape on 61-3-9205 9515, [sophie.pape@earthsystems.com.au](mailto:sophie.pape@earthsystems.com.au) for more information.

### Useful Web Solutions

- International Network for Acid Prevention  
<http://www.inap.com.au/>
- JKTech's SMI Knowledge Transfer group, formerly ACMER  
<http://www.acmer.uq.edu.au>
- Partnership for Acid Drainage Remediation in Europe (PADRE)  
<http://padre.imwa.info/>

### Upcoming Events

- 5 - 12 September 2010, **International Mine Water Association 2010 Symposium**, Nova Scotia, Canada. For more information visit: <http://www.imwa.info/imwa2010>
- 29 September - 1 October 2010, **Mine Waste 2010: 1<sup>st</sup> International Seminar on the Reduction of Risk in the Management of Tailings and Mine Waste**, Perth, Australia. For more information visit: <http://www.minewaste2010.com>
- 23 - 26 November 2010, **Mine Closure 2010: International Conference on Mine Closure**, Santiago, Chile. For more information: <http://www.mineclosure2010.com>

### Want to find out more ?

Please tick as appropriate and Fax back to Earth Systems:

- |   |   |
|---|---|
| <input type="checkbox"/> Send me information on Earth Systems new AMD Audit service | <input type="checkbox"/> Send me information on Earth Systems new OxCon Method  |
| <input type="checkbox"/> Send me a copy of the Earth Systems AMDact tool.           | <input type="checkbox"/> Send me information on Earth Systems Water Quality Management, AMD and Acid Sulfate Soils capabilities |

Comments / Suggestions:



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